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To test the assumption that conventional textbook prose contains words and word sequences unnecessary for comprehension, 210 blind children, all braille readers in grades 6, 7, 8, and 9, were divided into three groups and tested on a fictional story written in one of three different forms. Those forms included a traditional style (1620 words), a medium telegraphic style omitting narrative material (43% shorter), and a highly telegraphic style (72% shorter). Results indicated that subjects reading the two shorter versions required significantly less time ($p<.01$). However, the reading rate in words per minute was significantly higher for the subjects reading the traditional version ($p<.01$). Analysis of comprehension data revealed few significant differences among the three groups on either immediate recall or long term retention. In general, results appeared to support the feasibility of telegraphic learning materials as a method of increasing the rate of information input among blind children. (Author/JD)

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FINAL REPORT
Project No. R6-1179
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Clessen J. Martin

Lou Alonso

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Michigan State University

East Lansing, Michigan

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INTRODUCTION

Problem

The education of visually impaired children has been hampered by slow methods of material presentation. Since use of the tactile and auditory senses is not as efficient as normal sight, visually impaired children require a longer period of time to acquire information equal in amount to that of their seeing contemporaries. Visually impaired individuals read in braille, large type or through auditory means at slower rates than normally sighted individuals read print. While the sighted student can read about 250 words per minute (wpm), the braille reader averages about 90 words per minute.

A number of attempts have been made to remedy the problem of the relatively slow rate of material presentation for blind students. One attempt has been recording information to be learned on discs or tapes. This technique has alleviated the problem to some extent in that the characteristic speaking rate of a professional reader is approximately 175 wpm. However, this rate still compares unfavorably with the 250 wpm speed of the average sighted reader. The disadvantage is especially evident when one considers that comparable levels of comprehension may be attained at rates more rapid than 175 wpm.

The fact that comprehension is comparable at rates faster than the recorded rate has led to another approach to the problem: speeding up the rate of aural material presentation. Presently, there are two such methods. The first method requires the recording to be played at a speed faster than it was originally recorded. The second method utilizes an electronic time compression technique in which segments of speech are discarded. None of the discarded segments is large enough to destroy the intelligibility of a speech element. By using this technique, it is possible to compress sound up to at least 50 percent and still have it remain intelligible.

There is little doubt that the above techniques result in an increase in the rate of information input; however, both rely solely on the auditory sense. While earlier research studies were concerned with factors such as braille size, spacing, and contractions, no research has investigated the feasibility of altering braille materials for the purpose of increasing information input via the tactile sense. One of the advantages possessed by normally sighted individuals is that they may learn to scan and thus not attend to unimportant words, phrases, and sentences. Unfortunately, touch perception in braille reading does not lend itself well to rapid scanning techniques. Therefore, if the rate of information input is to be markedly increased via braille, elimination of certain materials becomes necessary.

In the formulation of this research project, it was assumed that typical textual material could be rewritten in such a fashion that low information words, phrases, and sentences could be eliminated without destroying the essential information contained in the paragraph. The objective of such elimination was to arrive at a set of materials which, though highly abbreviated and condensed, would contain all essential information. Such telegraphic materials would provide the reader with the important informational units and at the same time, achieve an economy of description and narration.

Following is a sample illustrating how material may be substantially reduced when high information words are retained, extraneous words eliminated, and ~~the~~ information rearranged. This passage discusses an early phase of Canadian history.

A. Typical Text

> The first Europeans to visit the shores of Canada were, ~~so~~ as far as we know, the Northmen. These daring seafarers found their way to the northeast coast of North America, by way of Greenland, about the year 1000. Their visits, however, left no trace behind; and for practical purposes the discoverer of Canada was John Cabot, an Italian merchant-sailor in the service of the king, Henry VII of England, who sailed from Bristol and touched at what is now Canadian soil in 1497--a year before Columbus reached the South American mainland on his third voyage. Cabot, like Columbus, was in search of a sea-route to Asia; and when he did not find on the bleak coast of North America the oriental silks and spices which he sought, he was bitterly disappointed. But though he did not find silks and spices, he found something no less profitable--the fish off the banks of Newfoundland. His son Sebastian, on his return to Europe, went so far as to report that the codfish were so numerous "they sumtymes stayed his shippes." As a result, fishermen from European ports began to come out to the banks of Newfoundland and established a permanent link.

B. Telegraphic Text

Northmen
    First Europeans to visit shores of Canada
    Came by way of Greenland around 1000
    Their visit left no trace behind

John Cabot
    Italian merchant
    Sailor in the service of Henry VII of England
    Sailed from Bristol and reached Canadian soil in 1497
    Like Columbus, in search of a sea-route to Asia
    Was disappointed when he didn't find oriental silks and spices, but his son, Sebastian, reported seeing numerous codfish which led to European fishermen coming to Newfoundland

While the typical text contains approximately 200 words, the telegraphic version contains just 79 words. This represents a reduction of 3/5 of the original text.

The basic question examined in this study is whether braille material presented in telegraphic style can be learned as effectively as material presented in a conventional style. It may be hypothesized that students do not require the superfluous words of each sentence to convey meaning when the important relevant information is present. In fact the rearrangement and omissions of certain low-information words, phrases, and sentences in typical contextual material may serve to increase the extent to which material is learned and retained. The basic purpose of this research is to determine whether high informational, condensed materials are as effective, if not more effective, than conventional full-text materials. It is this problem to which this research is addressed.

Related Research

The possibility of developing telegraphic materials was based upon the assumption that written and spoken language contains many words and word sequences which are unnecessary for the comprehension of a message. That is, in the usual message, there are words, phrases, and sometimes even sentences which add no further information. In information theory jargon, language is not particularly efficient in that there is a great deal of sequential dependencies, or redundancy. Although the measurement of redundancy is possible with artificial laboratory stimulus materials, it is practically impossible to obtain a direct measurement of redundancy in printed English.

The fact that redundancy is present in language and that subjects are aware of this redundancy has been demonstrated in a number of ways. Garner (1962) presents an excellent summary of this research. Although the research is not directly related to this project, it does provide some support for the possible feasibility of telegraphic materials. One way in which redundancy has been demonstrated is by subjects' ability to replace missing letters in words. The first demonstration of this fact was provided by Chapanis (1954). He selected several prose passages differing in difficulty. The essential aspect of this experiment involved deleting 1/10, 1/5, 1/4, 1/3, 1/2, and 2/3 of the letters on either a random or regular deletion basis. The results indicated that with regular 20 percent deletion approximately 90 percent of the missing letters were correctly restored. However, as percentage of deletion increased, accuracy fell off quite rapidly. When 50 percent of the text had been deleted, only about 10 percent of the text could be correctly restored. Another interesting finding was that in those passages where redundancy was low, difficulty in reconstructing them was great. In a similar experiment, Miller and Friedman (1957) replicated the Chapanis' results. Furthermore, they found that when they deleted and abbreviated all the vowels and spaces (resulting in 48 percent abbraviation), their subjects were able to produce 93 percent of the missing elements. Garner, in commenting on these results, suggests that the Miller and Friedman abbreviation technique comes close to providing an efficient method of recoding English without a corresponding loss in intelligibility.

While a relatively large percentage of letters can be deleted without an appreciable loss in intelligibility, the percentage is not as great with words. Morrison and Black (1957) required their subjects to replace missing words in sentences containing 1 to 6 deletions per sentence. The striking aspect of their results was that when a single word was deleted from a sentence, accuracy in replacing it was no greater than 50 percent. Similar results have also been obtained by Aborn, Rubenstein, and Sterling (1959). In fact, these results indicated that overall accuracy of replacement was approximately 40 percent.

While the word replacement data appear to cast some doubt on subjects' ability to replace deleted words from prose passages, data obtained by Aborn and Rubenstein (1958) illustrate the nature of their problem. In addition to the replacement task, these investigators required their subjects to write down eight different words which could be used to replace the deleted word. The results indicated that the subjects had little difficulty in finding eight different words to use in place of the deleted word. Even though subjects experienced difficulty in predicting the exact deleted word, they were able to supply a word which made the sentence meaningful.

The preceding studies illustrate the fact that redundancy is a feature of language. Because of the sequential dependencies in language, subjects are able to replace missing letters and words with a fair degree of accuracy. However, none of these studies has investigated the effect of deletion upon comprehension of the passage; even though subjects were able to replace missing elements with a fair degree of accuracy, evidence of comprehension was not obtained. Yet, the preceding studies provide a rationale for the feasibility of telegraphic materials.

The most important aspect of telegraphic materials is the elimination of nonessential information. Therefore, if a blind child were to maintain the same reading rate with telegraphic materials as with traditional materials, the rate of information input would be increased. The fact that rate of information input can be increased without appreciable loss in comprehension has been demonstrated in the compressed speech studies.

One of the earliest studies investigating the relationship between amount of time compression and comprehension of connected speech was conducted by Fairbanks, Guttman and Myron (1957). These investigators presented two different technical messages at five different time compression levels (0, 30, 50, 60, and 70%) to Air Force Trainees. The 0, 30, 50, 60, and 70% compression levels correspond to wpm rates of 141, 201, 282, 353, and 470 respectively. The results indicated that message efficiency, as measured by the amount of factual comprehension (multiple-choice items) per stimulus time, increased up to a message rate of 282 wpm. That is, when compared to the comprehension of the 141 wpm passage (0% compression), the 282 wpm comprehension was 90% effective. The 353 and 370 wpm rates were 70 and 41% effective respectively. Thus, these results indicate that there is little loss in comprehension up to and including the 282 wpm rate. However, there is a rather marked decrease in comprehension at the faster rates.

Similar results have been obtained by Faulke, Amster, Nolan and Bixler (1962). These investigators presented literary and scientific passages to sixth, seventh and eighth grade braille readers in braille and recorded form. The material was recorded at 175, 225, 275, 325, and 375 wpm. Comprehension of these materials was assessed by multiple choice items. Comparison of mean comprehension scores for each listening group with comprehension scores for braille readers indicated no significant loss in comprehension of the literary material up through 225 wpm. For the scientific material, there was no significant loss up through 275 wpm. However, when the faster rates were compared to the braille condition, there was a significant loss in comprehension. It appears that comprehension is impaired when the rates approach or exceed 300 wpm.

A more recent study by Faulke (1966) also indicates that comprehension is seriously affected at faster rates. The word rates studied in this experiment were 253, 300, and 350 wpm. In addition, two different methods of compressing speech were examined. While there was no difference in comprehension as a function of the two speech compression methods, there was a significant difference among the word rates. No post-mortem analyses were performed to determine which rates were different, but the mean comprehension scores for the 350 wpm groups were approximately one-half as large as the 253 wpm groups (12.80 and 10.36 for the 350 wpm groups compared to 23.65 and 21.19 for the 253 wpm groups).

The time compression studies demonstrate the fact that the auditory communication rate can be increased up to approximately 275 wpm without an appreciable loss in comprehension. These studies clearly indicate that subjects are able to process information via the auditory modality at rates faster than the ones encountered under normal conditions. These data, plus the redundancy data, suggest that more efficient methods of material presentation may be possible via the tactile modality. However, relatively little attention has been given to this problem as it relates to the preparation of braille materials.

A major problem which arises in any attempt to vary redundancy in meaningful prose passages is one of measurement. As previously mentioned, such measurement is possible with artificial laboratory materials but is practically impossible with meaningful materials. However, Dawes (1964) has developed a method which provides the basis for defining the essential structure of prose material. Because the method itself is artificial, it is difficult to analyze existing prose material. But it does provide a basis for operationally defining the essential information in artificially constructed meaningful material. With this method, it is possible to keep the amount of essential information constant among different types of specially constructed prose passages.

The essential feature of Dawes' model is the definition of the structure of prose material in terms of set relations. With this model it is possible to diagram the essential structure of a specially designed passage by the use of Venn diagrams. Dawes (1964) constructed a story about an imaginary island in the middle of the Atlantic. The people of the island had always been faced with a water shortage. Farming and cattle ranching were the main occupations. However, none of the ranchers engaged in farming, nor did any of the farmers engage in ranching. This information can be diagrammed as two exclusive sets. These two sets are presented in Figure 1.

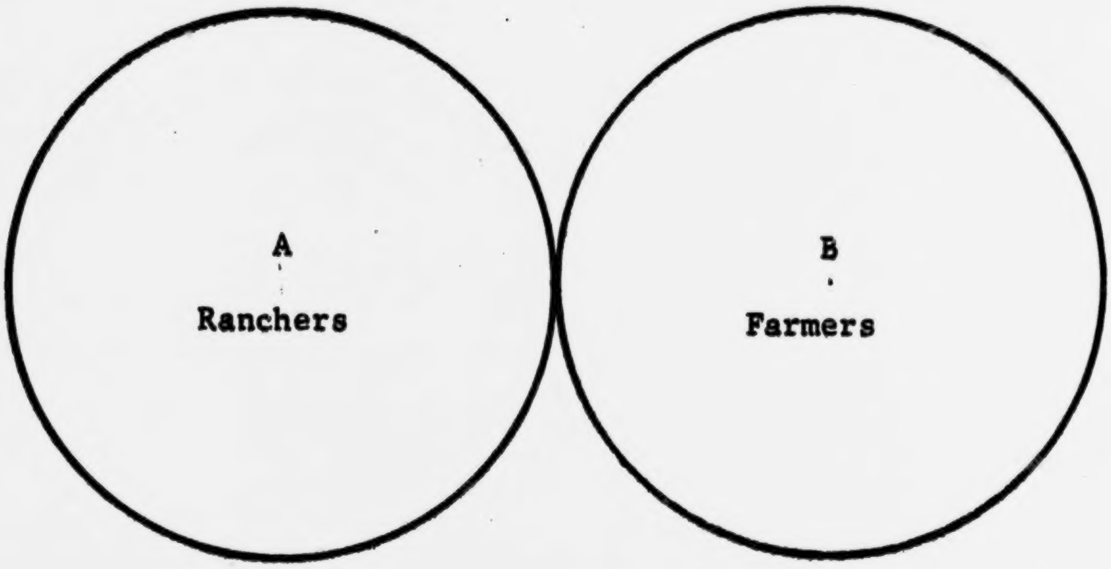

Figure 1. Diagram of two exclusive sets.

The story indicates that the island is governed by a 10-man senate composed entirely of ranchers. Thus, senators is a sub-set of ranchers. Figure 2 presents this relationship.

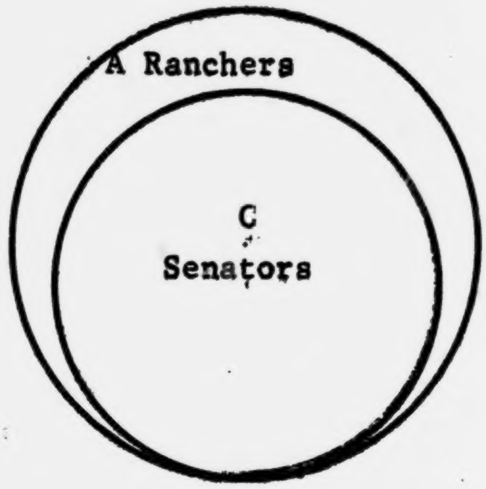

Figure 2. Diagram of a nested set.

Because senators are a sub-set within the set of all ranchers, this relationship is referred to as a nested relationship.

The story also tells of a pro-canal association which was formed by some of the farmers and a few of the senators. Thus, the pro-canal association is represented by an overlapping set of some senators and some farmers. Figure 3 presents this relationship.

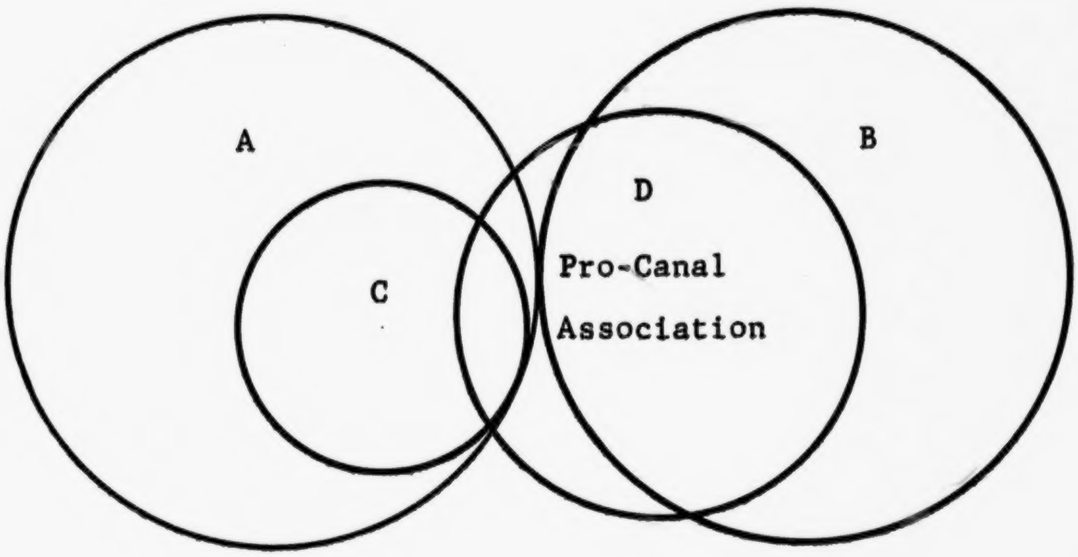

Figure 3. Diagram of a disjunctive set.

Sub-set D is referred to as a disjunctive relation because it contains elements which are common to both A and B. The final set in the story involved those islanders who voted for the idea of constructing a canal. This set is labeled the pro-voters and consists of all members of the pro-canal association and all farmers. Figure 4 represents in Venn diagram form the structure of the story.

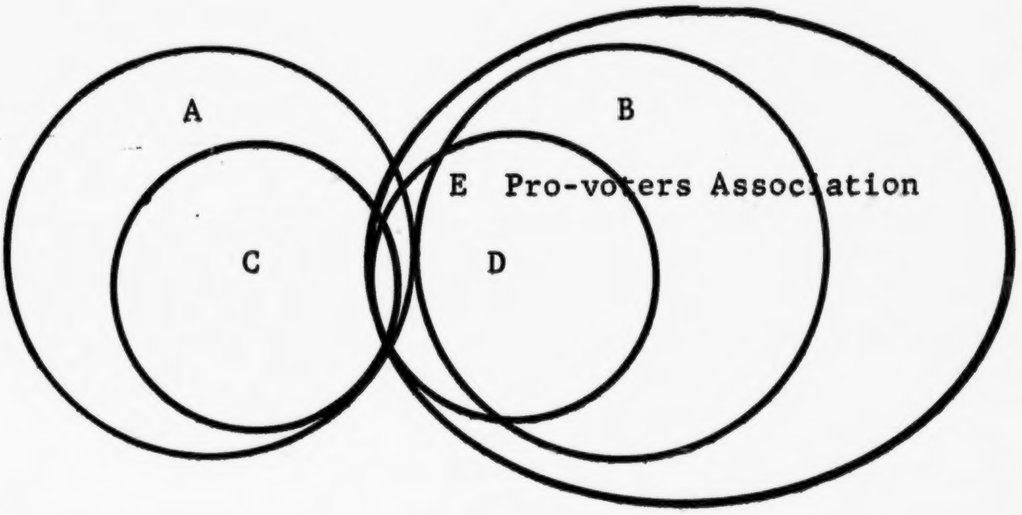

Figure 4. Diagrammatic representation of the structure of Dawes' Story 1.[1]

Although most prose material is not amenable to a set relation analysis, the Dawes' model does permit one to construct a passage whose structure is definable in terms of nested and disjunctive relationships. Therefore, it is possible to develop prose materials which vary with respect to the amount of nonessential information contained in them. Essential information is defined as materials which describe the set relations. This model also permits one to keep the amount of essential information constant among various prose passages.

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[1] after Dawes (1964).

A second feature of this model is that it allows one to test the comprehension of some rather complex relationships. Dawes postulates two types of errors possible in the recall of the set relations. If in the recall of a nested set such as the one presented in Figure 2, a subject recalls set C as overlapping or disjunctive with sets A and B, then the subject has made a pseudo-discrimination error; that is, he has made a discrimination when in fact there was none. On the other hand, a subject may fail to recall a discrimination that was present in the passage, as in Figure 3, not recalling that some farmers, some ranchers, and some senators belonged to the pro-canal association. Or, if a subject fails to recall that some, rather than all or no members of a set were included in another set, he is failing to make a discrimination where one in fact existed; such an error is termed an overgeneralization error. Thus, the model makes it possible to measure the comprehension of the two types of set relations.

A third and rather interesting aspect of Dawes' study was the type of errors which were made in recall. As predicted, he found that overgeneralization errors were more common than pseudo-discrimination errors. The explanation which he offered for these findings was one of information overload. Since overgeneralization results in a reduction in the number of categories in the passage (e.g., in Figure 3, the subject fails to recall that a portion of set D is contained in sets B, C, and A) it reduces the amount of information contained in the passage. Pseudo-discrimination errors, on the other hand, produce an increase in amount of information. Because of the limitation in human memory, it was not surprising that Dawes' subjects made more overgeneralization than pseudo-discrimination errors.

Dawes' model not only affords a technique for holding the amount of essential information constant across the three versions, it also provides a basis for comparing the telegraphic and traditional passages on the type of recall errors made. Assuming that overgeneralization errors occur as a result of information overload and since the shorter passages contain less information, the model may be interpreted as predicting proportionately fewer overgeneralization errors in the telegraphic passages. Although all passages contain the same set relation material, they differ in the amount of extraneous material. It is the latter which increases the amount of total information in the passage and consequently may interfere with the recall of the basic set relations. Thus, analysis of the set relation recall errors may offer the opportunity of determining whether or not telegraphic materials make less imposition upon memory than traditional materials.

While it is interesting to speculate on the type of set relation errors predicted by the Dawes' model in the recall of the traditional and telegraphic materials, this is not the major advantage of the model. The utility of this model is that it makes possible an operational definition of essential information, thereby permitting this information to be held constant across all versions. Furthermore, the model provides a method for directly assessing the comprehension of the complex set relations.

Objectives

The general objective of this research was to determine the feasibility of presenting prose material in telegraphic form to visually handicapped children. The goal was to increase the rate of information input via braille in much the same manner as auditory information input has been increased via the time compression techniques. In attempting to accomplish this goal, low information words, phrases, and sentences were eliminated from more traditional prose materials, thereby greatly reducing the total number of braille characters in the telegraphic passages. To study the feasibility of telegraphic materials, the following specific tasks were involved:

1. Preparation of brailled learning materials. To insure that the subjects would be unfamiliar with the materials, a fictional story concerning two warring African nations was written in traditional prose form. The content of the story provided for an analysis of the essential information in terms of the Dawes' model: the central ideas of the passage were the set relations. Then a telegraphic version of the story was prepared using a traditional sentence and paragraph form in which narrative and background material was reduced 42%. Finally, a short, telegraphic version written not in sentence and paragraph form but in a form resembling a telegram, permitted a 72% reduction of the original passage. While there was a marked reduction in the total number of words in the two styles of telegraphic passages, the essential information pertaining to the set relations was the same in all three versions.

2. Assessment of comprehension. Three different methods of measuring comprehension were developed to provide a broader basis upon which to evaluate the relative effectiveness of the three treatment versions.

    a. Multiple-choice items. Thirty-nine multiple choice items were constructed from the traditional prose version. Twenty-three of these items could be answered from all three of the treatment versions. The remaining sixteen items could not be answered on the basis of the information provided in either or both of the telegraphic versions. It was assumed that this method of measuring comprehension most closely approximated the typical methods used in the classroom.

    b. Set relation items. This method of assessing comprehension had two potential advantages. One advantage was that these items afforded an opportunity to measure the comprehension of the complex set relations presented in the three treatment versions. It was assumed that these items demanded the recall of more complex information than that demanded by the multiple choice items. A second advantage of the set relation items was that they offered an opportunity to evaluate more specific features of the three prose passages. In particular, since the Dawes' model assumes overgeneralization errors to be due to memory limitations, and since the telegraphic versions were designed to reduce the amount of extraneous information, it was predicted that proportionately fewer overgeneralization errors would occur in the telegraphic versions than in the traditional version.

c. Reconstruction task. The third method of assessing comprehension required the subjects to prepare a written reconstruction of as much of the original passage as they could recall. While this type of task posed some scoring problems, it does represent the type of situation often encountered in essay-type tests. Furthermore, it permitted a comparative analysis of the writing style of the subjects receiving the three different versions. More specifically, it was possible to determine whether subjects receiving the telegraphic versions tended to write their reconstructions in a telegraphic style.

3. Assessment of long-term retention. In order to determine the effects of the three versions on long term retention, the above recall tasks were administered again one week after original reading of the passages. The delayed retention interval made it possible to determine whether there was an interaction between the three treatment versions and the two retention intervals.

METHOD

Subjects

The subjects were 210 sixth, seventh, eighth and ninth grade students. Of this total, 198 of the subjects attended state residential and day care schools for the blind: the Michigan School for the Blind, Lansing, Michigan, (83 subjects); the Indiana School for the Blind, Indianapolis, Indiana, (44 subjects); and the State School for the Blind, Columbus, Ohio, (71 subjects). The remaining 12 subjects attended public schools in Oakland County, Michigan. All subjects had received formal braille instruction for four years or more. None of the subjects was informed of the nature of the study.

Materials

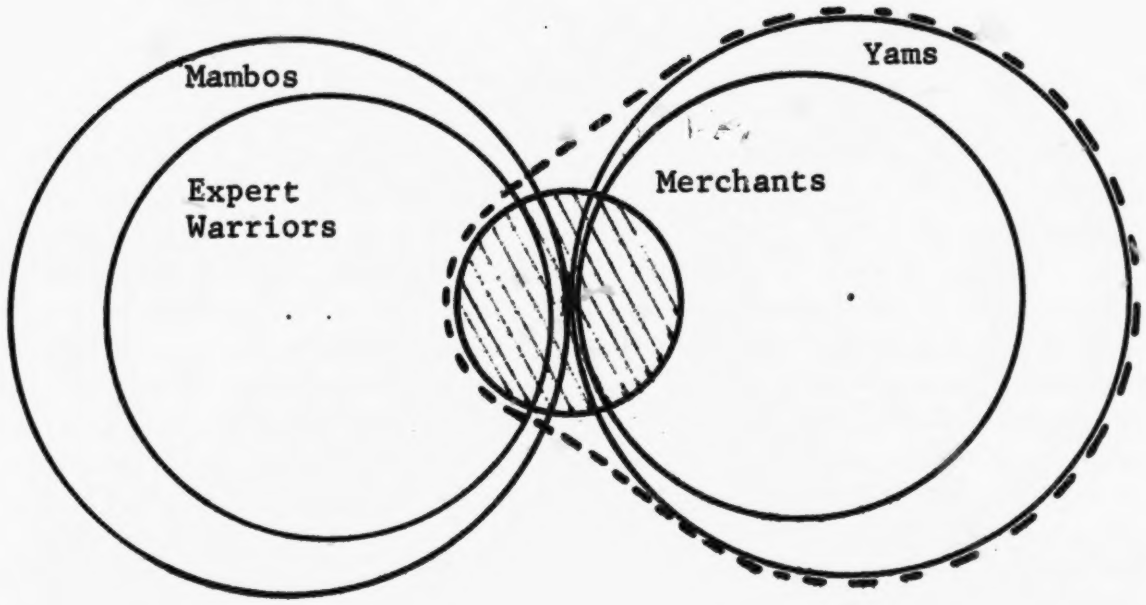
Basic Structure of the Three Treatment Versions: The construction of the set relations framework. One-third of the subjects read a traditional passage, one-third read a medium length telegraphic version, and one-third read a short telegraphic version. The full text of each version appears in Appendices A, B, and C.

The three versions contained the same essential information. The same sequence of events was maintained and the same persons and groups of persons were identified in all three versions. Most important, the changing relationships among the groups during the course of events were systematically maintained in all three versions. These relationships constituted the political structure of the two warring African nations, Mambo and Yam, and provided the essential framework upon which all versions were based. Figure 5 illustrates the two types of nested and disjunctive relations that were described before the battle, and Figure 6 illustrates the relations after the battle.

Both diagrams contain the same number of sets and maintain the same basic relationships. However, the labels of some of the sets change as a result of the changes in the political structure of the two nations.

Readability. The three treatment versions were constructed so that the readability indices were comparable. The Dale-Chall formula (1948) was used to compute a readability index for each treatment version. The traditional version had a formula raw score of 6.67, the medium telegraphic version a formula raw score of 6.82, and the short telegraphic version a formula raw score of 6.76. According to the correction table constructed by Dale and Chall, socres in the 6.0-6.9 range indicate reading material that can be read with understanding by average children in grades seven and eight. While the material might have been somewhat more difficult for the sixth grade subjects and somewhat easier for the ninth grade subjects, these subjects were equally distributed in the nine experimental groups.

The process of reducing prose length: Style. The traditional version was written first and then extraneous words, phrases and sentences were eliminated in order to produce the medium and short telegraphic versions.



Area Surrounded by Dashes = Lester Followers; Shaded Area = Pro Lester Union

Nested Relations

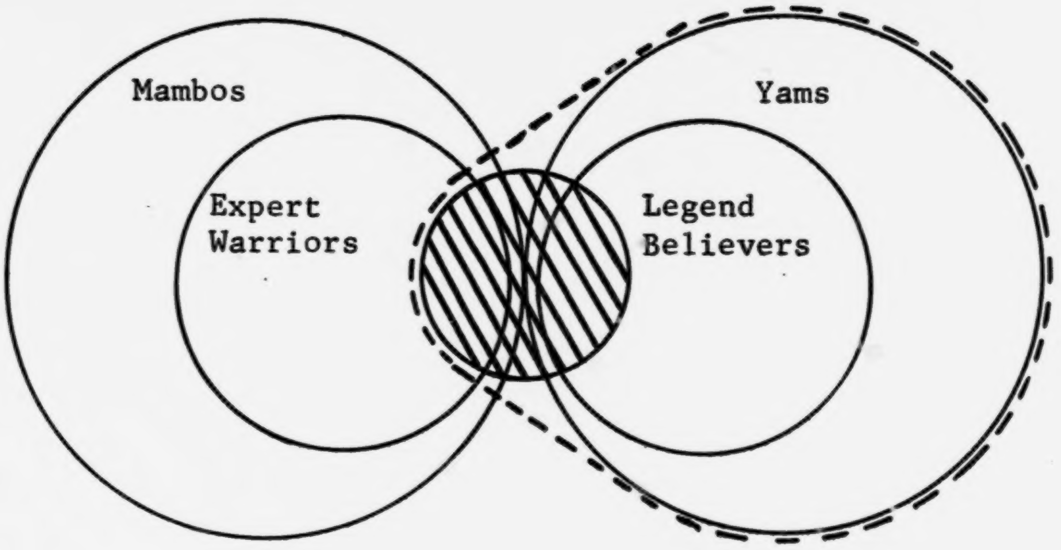
All expert warriors are Mambos
All merchants are Yams
All Yams are Lester Followers
All merchants are Lester Followers
All members of the Pro Lester Union are Lester Followers

Disjunctive Relations

Some Mambos are Lester Followers
Some expert warriors are Lester Followers
Some Mambos are members of the Pro Lester Union
Some expert warriors are members of the Pro Lester Union
Some merchants are members of the Pro Lester Union
Some Yams are members of the Pro Lester Union

Figure 5. Set relations existing before the battle as described in all three treatment versions.

The narrative style of the traditional version (A) was one of the factors contributing to its greater length. Such phrases as "However, there is an interesting legend . . . .", "It is interesting to point out . . . .", as well as rhetorical questions such as "But what of Yam?", created a hypothetical relationship between writer and reader not unlike the style of texts written for elementary and junior high school students. The medium telegraphic version (B) did not include this type of material, nor did the short telegraphic version (C). Also, versions A and B, the latter to a lesser extent, presented background material about such matters as time of day an event took place, the moods of the persons participating in the story, the possible reasons for an action taken, and comparisons to other times.



Area Surrounded by Dashes = Slaves; Shaded Area = Freedom Group

Nested Relations

All expert warriors are Mambos
All legend believers are slaves
All Yams are slaves
All Legend Believers are Yams
All members of the Freedom Group are slaves

Disjunctive Relations

Some members of the Freedom Group are Mambos
Some members of the Freedom Group are Yams
Some members of the Freedom Group are Legend Believers
Some members of the Freedom Group are expert warriors
Some Mambos are slaves
Some expert warriors are slaves

Figure 6. Set relations existing after the battle as described in all three treatment versions.

As a result of its lack of narrative phraseology and extra background material, version C, when compared to versions A and B, also had a markedly smaller number of repetitions of key content words. The number of content words repeated after once having been used in a given version is 344 for the version A, 277 for the version B and 116 for version C. In other words, the use of the narrative and background material resulted in a concomitant repitition of the content words so that the reader of version A read approximately three times as many repeated content words than the reader of version C. Table 1 presents the distribution of the number of content words in the three versions.

Table 1. Distribution of the number of content words in the three versions.

	Version A	Version B	Version C
Different Content Words	310	210	152
Content Words Used Repetitively	344	277	116
Other Words	966	460	187
Total	1620	947	455

Sentence structure changes in the reduction process: Grammar, punctuation and indentation. Although versions A and B differed in narrational and background material, they were essentially alike in sentence structure. The C version, however, varied considerably from the conventions of ordinary English usage. It contained a total of 32 sentences (a sentence is defined here as a string of words beginning with a capital letter which follows a period and is terminated by a period). Four of these sentences lacked either a subject pronoun or noun, or a complete verb form in the predicate, because the words themselves were predictable from the remaining words in the sentence and were therefore considered to be redundant. Sentences in version C were also shorter (14.2 words per sentence) than sentences in either version A or B (17.4 and 17.5 words per sentence respectively). This words-per-sentence reduction was in part due to the use of colons and semi-colons as substitutions for unnecessary words. For example, in the sentence from version C, "Yam: Ruled by rich, handsome King Lester, loved by his subjects," the word "was" was replaced by a colon.

The final length of the three versions was: A, 1620 words; B, 947 words: C, 455 words. The latter reduction was accomplished by the elimination of some whole sentences present in the A version a well as the B version. Virtually none of the sentences of the C version was identical to the sentences in the A or B versions. The elimination of words considered to be unnecessary to the understanding of the basic facts of the story permitted the combining of selected sentences and phrases, exemplified on the following page. In this example, the word "continent" has been eliminated as information that is not necessary to establish the two important sets, the Mambos and the Yams. The redundant use of "nation" and "two" in version A has been partially eliminated in version B and wholly eliminated in version C.

Version A	Version B	Version C
In the year 1800 on the continent of Africa, two unfriendly nations existed, the nation of Mambo and the nation of Yam. The Nile River separated these two nations.	In the year 1800 on the continent of Africa, two unfriendly nations existed, Mambo and Yam. The Nile River separated them.	In Africa, in 1800, the Nile River separated two unfriendly nations, Mambo and Yam.

This reduction procedure had little effect on the relative numbers of various parts of speech in each story with the exception of the number of definite and indefinite articles. The ratio of articles to all other parts of speech is .09 for versions A and B and .02 for version C. This resulted from the deliberate elimination of "a's" and "the's" in the latter wherever possible. Table 2 presents the numbers of the 13 parts of speech contained in the three versions.

Table 2. Numbers of 13 parts of speech in the three versions.

Parts of Speech	Version A	 B	 C
Nouns	409	256	141
Verbs	233	141	73
Adjectives	175	81	73
Prepositions	148	93	41
Articles	136	76	8
Conjunctions	106	70	31
Pronouns	105	39	10
Adverbs	80	25	16
Negatives	70	56	31
Noun Modifiers	34	27	12
Possessive Nouns	14	11	6
Possessive Pronouns	13	11	8
Expletives	2	0	1

The physical arrangement of version C permitted further revision into unconventional sentence patterns. Sentences following a sentence which introduced an important new person, group or event were indented beneath the introductory topic sentences, as follows:

Version A	Version B	Version C
King Koko prepared his army for war and the most important preparation was the worship of Solmambo, the sun-god.	King Koko prepared his army for war and the most important was the worship of Solmambo, the sun-god.	Koko prepared Mambo army for war by: first, worship of Solmambo, their sun-god.

This type of physical arrangement made some types of subordination more obvious and permitted the elimination of other words and phrases.

Procedure and design of the study.

All subjects were assigned to one of the three treatment versions: Traditional (A), Medium Telegraphic (B), and Short Telegraphic (C). Subjects were assigned to the nine groups on the basis of age, IQ, and reading achievement. The objective was to form groups which had comparable means and variances on these three variables. However, for some subjects, information on all three variables was not available. For these subjects, assignment was based upon whatever information was available. The means, ranges, and standard deviations for each of the nine groups on the three variables is presented in Table 3. Three 1 x 9 analyses of variance were performed. The resulting F values were: .27 for age, .25 for IQ, and 1.02 for reading achievement. The results indicate that all nine groups were comparable on these three variables.

Within each group assigned to a particular version, there were three subgroups assigned to one of the three recall conditions: set relations (1), multiple choice (2), and reconstruction(3). The general design of the study is illustrated as follows:

TREATMENT VERSION	RECALL CONDITION		
	Set Relations(1)	Multiple Choice(2)	Reconstruction(3)
Traditional (A)	A-1	A-2	A-3
Medium Telegraphic (B)	B-1	B-2	B-3
Short Telegraphic (C)	C-1	C-2	C-3

Recall was measured immediately after reading the assigned version and again one week later without rereading the passage. Each subject was retested in

Table 3. Means, standard deviations and ranges on the age, IQ, and reading achievement variables for the nine groups.

	Age				I.Q.				Reading Achievement Level			
Experimental Group	n	Mean	SD	Range	n	Mean	SD	Range	n	Mean	SD	Range
A-1 Traditional-Set Relations	17	13.8	1.5	10.8-16.2	15	104	14	71-126	14	7.6	1.6	5.2-11.9
A-2 Traditional-Multiple Choice	17	14.0	1.4	10.1-16.1	15	106	21	66-128	12	7.6	2.0	3.8-10.6
A-3 Traditional-Reconstruction	20	14.0	1.1	11.8-15.8	18	102	17	69-130	16	7.0	2.0	4.8-10.5
B-1 Medium Telegraphic-Set Relations	22	14.1	1.1	12.1-16.2	22	100	21	67-140	17	7.4	1.8	4.7-12.0
B-2 Medium Telegraphic-Multiple Choice	17	14.0	1.4	12.0-16.8	17	103	12	79-123	13	7.0	1.8	3.2-10.6
B-3 Medium Telegraphic-Reconstruction	20	14.1	1.4	11.6-17.1	20	101	17	81-129	18	6.9	1.6	4.8-10.1
C-1 Short Telegraphic-Set Relations	22	14.4	1.6	11.2-17.3	21	101	16	75-132	16	7.5	1.7	4.4-11.2
C-2 Short Telegraphic-Multiple Choice	21	13.9	1.2	11.8-16.3	21	105	16	80-150	17	7.3	1.5	5.1- 9.9
C-3 Short Telegraphic-Reconstruction	17	14.0	1.2	12.2-17.2	14	104	16	77-128	15	7.4	1.9	4.9-11.3

the same recall condition as the one originally assigned.

The actual testing was conducted in all participating schools during the period from September, 1966 to February, 1967.

Attenuation of subjects. Sixteen subjects were eliminated because they did not complete the recall test materials in the allotted time. Nine additional subjects who were absent from either the first or second recall session and five subjects who failed to follow instructions were also eliminated.

Because a total of thirty subjects was eliminated for the above reasons, it was decided to retain a subject's responses to the multiple choice items if he had completed at least thirty of the thirty-nine items in the first session. However, if a subject completed fewer than thirty items during the first testing session, neither his first nor second session responses was retained and he was eliminated from the study.

No similar decision was necessary for the subjects in the other two recall conditions.

Table 4 presents the number of subjects eliminated and retained in each of the nine experimental groups. A total of 14 subjects was eliminated from the traditional groups, 7 from the medium telegraphic groups and 9 from the short telegraphic groups.

The three recall conditions: Set Relations. This recall condition was specifically designed to measure subjects' retention and distortion of the set relations. The test consisted of 20 items, 10 of which were concerned with nested relationships and 10 items with disjunctive relationships. Each item required the subject to circle the true statement from a pair of statements presented in braille, i.e., "all of the expert warriors belong to the Pro Lester Union," or "only some of the expert warriors belonged to the Pro Lester Union." Half of the nested and half of the disjunctive items pertained to relationships as they were described before the battle and half of each type pertained to events after the battle. The set relations test is presented in Appendix D.

Multiple Choice. This test consisted of 39 four-alternative multiple choice items based on the important events, setting, and people in the story. The primary purpose of this test was to test retention of factual type information.

Both the set relations and multiple choice tests were printed in braille and attached to the story booklets. Braille answer sheets were separate. The subjects were instructed to circle their choice on the braille answer sheets. The multiple choice test is presented in Appendix E.

Reconstruction. In this recall condition, subjects were instructed to reconstruct the story from memory. They were asked to use sentences and paragraphs, and to follow the original sequence of the story as closely as possible. Subjects wrote their reconstructions using slates and styli or

Table 4. Elimination and retention of subjects according to school attended and experimental group.

	School				
Experimental Group	Michigan	Indiana	Ohio	Oakland	Total
A-1 (Traditional-Set Relations)					
Eliminated:	1	1	2	1	5
Retained:	9	2	5	3	19
A-2 (Traditional-Multiple Choice)					
Eliminated:	1	0	5	0	6
Retained:	8	6	2	3	19
A-3 (Traditional-Reconstruction)					
Eliminated:	2	0	1	0	3
Retained:	9	2	9	0	20
B-1 (Medium Telegraphic-Set Relations)					
Eliminated:	1	0	0	0	1
Retained:	7	4	11	0	22
B-2 (Medium Telegraphic-Multiple Choice)					
Eliminated:	1	1	2	0	4
Retained:	4	7	6	0	17
B-3 (Medium Telegraphic-Reconstruction)					
Eliminated:	1	0	1	0	2
Retained:	8	5	7	0	20
C-1 (Short Telegraphic-Set Relations)					
Eliminated:	1	0	0	0	1
Retained:	9	6	7	0	22
C-2 (Short Telegraphic-Multiple Choice)					
Eliminated:	2	0	2	0	4
Retained:	8	7	6	0	21
C-3 (Short Telegraphic-Reconstruction)					
Eliminated:	3	0	1	0	4
Retained:	8	3	4	5	20
Total Subjects Eliminated:	13	2	14	1	30
Total Subjects Retained:	70	42	57	11	180
Total:	83	44	71	12	210

braillers. Their stories were later transcribed to print formed by a trained braille instructor.

Immediate and delayed recall sessions. A group testing procedure was used in both the immediate and delayed recall sessions. The size of the groups ranged between 10 and 25 subjects. They were brought from their classrooms to a room specifically provided for the experimental sessions. The administration of the reading and retention tasks was supervised by 4 or 5 monitors.

The instructions were read aloud to the group of subjects as they followed the same instructions printed in their braille test booklets. The instructions were:

> We would like you to read carefully the following short story. After reading it, each of you will be tested for what you remember in different ways. Some of you will be asked to answer questions and some will be asked to tell all you remember about the story, so don't pay attention to what the person next to you is doing. For those of you who are asked to write the story, we want you to write in sentence and paragraph (not outline) form, and to follow the original sequence as closely as you can. Do not turn the page until you are told to do so. Are there any questions?

Subjects were then told to begin and monitors recorded the starting time. Subjects were permitted to ask for help with unfamiliar words. The last sentence in all three versions instructed the subjects to raise their hands. A monitor then went immediately to the subject, recorded the time elapsed since the signal to begin, and then asked the subject to read the instructions preceding the assigned recall test. Subjects were self-paced in both the reading task and retention test. The 12 subjects from Oakland County, Michigan, were tested individually following the above procedure.

Prior to session 2, subjects were not told they would be retested. The second recall session was conducted in the same manner as the first, with the recall tests given in the same room with the same group of subjects. However, the subjects were not given an opportunity to reread the story. The following instructions were read aloud as the subjects listened:

> Last week, after reading a short story, you were asked to indicate what you remembered of it. Some of you were asked to answer specific questions and some of you retold the story in your own words. Today, we would like you to do the same as you did last week. You will not reread the story. For those of you who are asked to write the story, we want you to write in sentence and paragraph (not outline) form, and to follow the original sequence as closely as you can.

Each subject was then administered the same recall condition administered to him in Session 1.

Scoring of Dependent Variables

Set relations. The retention of the set relations was measured by (1) a total items correct score and (2) a simplification score (s-score) which was defined as the number of nested items correct minus the number of disjunctive items correct. The s-score was divided into two subscores, one for the ten items based on before-the-battle set relations and ten items based on after-the-battle relations.

Multiple choice. Three different scores were derived for this 39-item test: a score for total items correct, a score based on 23 items (common items) which could be answered from the information contained in all three treatment versions, and a third score for 16 items (non-common items) for which answers could only be inferred on the basis of information contained in the medium and short telegraphic versions.

Reconstruction. Scoring of the immediate and delayed recall reconstructions was based upon the following dependent variables:

1. Total words
2. Total sentences
3. Average words per sentence
4. Total kernel sentences
5. Total kernel sentences matching kernel sentences in treatment version A
6. Total kernel sentences that are true inferences but not matches to kernel sentences in treatment version A

7-19. Totals of each of 13 parts of speech

20. Different key words
21. Total key words
22. Reading time

For the most part, scoring of the reconstructions on total words, total sentences, and average words per sentence was fairly straightforward. However, due to lack of punctuation in some subjects' reconstructions, the length of the sentences had to be arbitrarily judged.

Dependent variables 4, 5, and 6 resulted from a method of scoring subjects' reconstructions which was devised specifically for this project. The goal was the development of a methodology which would permit the specification of objective quantification rules whereby subjects' written recall of prose passages could be evaluated. Any such method must yield reliable scoring units and must be amenable to different writing styles. In addition, the method must permit the separation of incorrectly recalled information from correctly recalled information.

A simple count of the number of sentences failed to meet these criteria. The following sentences were extracted from subjects' reconstructions.

S-182 "King Lester was trying to kill King Koko King Lester was ready to strike. but king Koko through the sword into his chest"

S-184 "Near the end of the story, it was told how the King was killed in the Yam tribe, and how they lost their wealth, and how the people were taken as slaves."

S-201 "King Lester was killed by King Koko."

S-216 "Koko hit Yam in the chest with a sharp sword it came out of his back and he was dead."

S-196 "He went up to King Koko and when he was just about ready to stick his weapon into the king, King Koko came up with his spear and put it through until it stuck out of his back."

S-188 "Then King Koko saw King Lester and charged for him. King Lester tried to throw his spear, but it was too heavy for him. So King Koko killed King Lester."

In S-182's excerpt, the lack of punctuation produced obvious difficulties. Comparison of S-216's sentence to S-196's sentence reveals further difficulty. The former contained errors of identification (Yam is substituted for Lester, sword for spear). Another problem arose in connection with S-184's sentence. Relevant information must be separated from irrelevant material such as "Near the end of the story it was told how." Still another problem arose when sentences of S-196 and S-188 were compared. They appeared to contain approximately the same information, but the style of writing and the number of sentences was different for the two passages.

As a solution to these problems, the concept of the kernel sentence was employed. By reducing the reconstructed stories to kernels, it was possible to separate correct information from incorrect, eliminate irrelevant material, and adjust for differences in style.

Kernel sentences refer to simple, active, declarative sentences. The exact number of such distinct patterns existing in English is not agreed upon by linguists. However, for purposes of this study six patterns were sufficient. Any other sentence pattern could be shown to be a variation of one of these six. All patterns consist of a noun phrase plus a verb phrase. Words and word clusters within the noun and verb phrases fall into four word classes: noun, verb, adjective, and adverb. In Table 5 the six patterns used in the present analysis are shown with the form class labeled and examples from subjects' reconstructions presented.

The kernel may be considered the basic information unit of spoken and written English (Roberts, 1956). Any sentence may be rewritten into one or more of the six basic kernels. Table 6 illustrates the rewrite procedure employed in transforming the original sentences into kernel elements.

Table 5. Six basic patterns of kernel sentences and examples of each pattern.

	Pattern	Examples
1.	N V (Subject--Intransitive Verb)	Lester fell. He died.
2.	N V PDJ (Subject--Linking Verb--Predicate Adjective)	Yam was richer. Lester seemed brave.
3.	N_1 V N_1 (Subject--Linking Verb--Predicate Noun)	Koko was king. The Mambos were warriors.
4.	N_1 V N_2 (Subject--Transitive Verb--Direct Object)	Koko planned war. The warriors trained merchants.
5.	N_1 V N_2 N_3 (Subject--Transitive Verb--Indirect Object--Direct Object)	Koko gave Lester a jab. The warriors taught the merchants tricks.
6.	N V ADV (Subject--Intransitive, Transitive or Linking Verb--Adverb)	The battle lasted several hours. Koko paddled down the river.

The following rewrite rules were developed to assist the judges in transforming the reconstructions into kernel form:

1. Identify the noun phrases and verb phrases.
2. Separate each noun phrase--verb phrase pair from other such pairs which have been combined via coordination and/or subordination.
3. Identify and label all the words and/or word clusters which are one of the four form classes, noun, verb, adjective, or adverb.
4. Rewrite passive transformations into active form.
5. Rewrite the question as a noun cluster functioning as the object of a statement. For example, "Koko asked, 'Will we win?'" is a pattern four kernel.

6. Rewrite adjective-noun pairs into kernels by supplying a linking verb between the adjective and the word modified by it. When the same pair recurs in the same reconstruction, regard the pair as a unit. Do not rewrite into a separate kernel a second time.

7. Include parenthetically any qualifying phrases which are not informationally independent. For example, "He would become rich (if he defeated Yam)," is one kernel.

8. Include as part of the sentence pattern simple phrases which operate as nouns, adjectives, or adverbs when these phrases are necessary to an informationally independent pattern. For example, "Koko paddled down the river," a pattern six kernel, contains the cluster "down the river." In "Yam warriors were no match for Mambo's," a pattern three kernel, "no match for Mambo's" is a predicate noun cluster.

Table 6. Transformation of original sentences into kernel elements.

Original Sentence	Derived Kernel	Classification
Koko killed Lester.	(Koko killed Lester.)	1. Unaltered
Koko is king and he killed Lester.	a. Koko is king. b. He killed Lester.	2. Coordinated
Since Koko is an expert, he killed Lester.	a. Koko is an expert. b. He killed Lester.	3. Subordinated
Lester was killed by Koko, an expert warrior.	a. Koko killed Lester. b. Koko is warrior. c. Koko is expert.	4. Transformed
Koko and the expert warrior killed Lester while he was running.	a. Koko killed Lester. b. The warrior killed Lester. c. The warrior is expert. d. Lester was running.	5. Combination of arrangements 1-4.

The traditional version of the story, Treatment Version A, was completely rewritten in kernel sentence form. All kernels on the resulting "master list" were numbered consecutively. These numbers functioned as categories. Every kernel derived from a subject's reconstruction either matched a kernel on the master list or could be categorized into one of the following five categories.

1. TNM: (True inference but no match.) Example: "There was a battle and someone was the winner." A glossing-over of the terminology used in the treatment version, or an over-fine elaboration of a fact presented in the treatment version.
2. EI: (Error of identification or association.) The kernel would be a match but a name attached to a person, group or place contained in the kernel is incorrectly given.
3. EE: (Extraneous explanation.) Material interjected into the story of an irrelevant nature, such as "and that's all I remember about the story. The End."
4. FS: (False statement.) The kernel as a whole is incorrect, and is contradicted by a master list kernel.

5. FI: (False inference.) The kernel makes a dubious statement relevant to events in the story but is not directly contradicted by statements presented in the story.

Since the information presented in the B and C versions was also contained in the A version, the master list of kernel elements was derived from the version A only. Appendix J presents an example of the rewrite procedure and the results of several reliability analyses. In summary, none of the interjudge correlation coefficients on the number of kernel sentences rewritten independently by each judge was below .97.

Dependent variables 7-19 employed in the analysis of subjects' reconstructions were based upon the number of each of 13 parts of speech. Each word was classified into one of the following categories: nouns, verbs, adjectives, adverbs, pronouns, prepositions, conjunctions, determiners, noun modifiers, expletives, possessive pronouns, possessive nouns, and negative adverbs.

Dependent variables 20 and 21 were based upon the number of different key words and number of total key words contained in each subject's reconstruction. Key words were arbitrarily selected from each of the three treatment versions. These words tended to be ones which referred to persons, places, and actions described in the passages. For the most part, these words were either nouns, pronouns, or verbs.

Dependent variable 22 was simply based upon the amount of time the subjects required to read their original treatment versions.

RESULTS

Analysis of Time and Reading Rate Data

The total number of minutes required to read the story was recorded for each subject. Table 7 presents the means and standard deviations for the nine groups.

Table 7. Mean number of minutes and standard deviation required to read the story for each of the nine groups.

Recall Method		Version A	Version B	Version C
Set Relations	Mean	19.73	15.28	12.25
	SD	7.14	6.83	6.15
Multiple Choice	Mean	19.23	14.22	9.02
	SD	6.11	3.34	3.32
Reconstruction	Mean	24.60	15.28	8.78
	SD	14.08	7.23	3.13

A separate 1 x 3 analysis of variance was performed on each of the recall methods. Table 8 presents the results of the analysis for the three groups receiving the set relations test. A significant difference was found in the

Table 8. Analysis of variance summary table of time taken to read the story for groups receiving the set relations test.

Source	df	MS	F
Versions	2	284.84	6.35**
Error within	60	44.83	
Total	62		

$^{**}p < .01$

mean number of minutes required to read the three different versions. Individual comparisons by means of the Tukey (a) Test showed that subjects reading versions B and C required significantly ($p<.01$) less time than subjects reading version A. However, there was no significant difference between versions B and C.

Table 9 presents the results of the 1 x 3 analysis of variance for the multiple choice recall method. This analysis also indicated a significant difference among the three groups in the number of minutes required to read the original passages. Individual comparisons by means of the Tukey (a) Test revealed that all groups differed significantly ($p<.01$) from each other.

Table 9. Analysis of variance summary table of time taken to read the story by groups receiving the multiple choice test.

Source	df	MS	F
Versions	2	521.34	26.24***
Error within	54	19.87	
Total	56		

***$p<.001$

Table 10 presents the results of the 1 x 3 analysis of variance for the reconstruction test. Again the analysis indicated a significant difference

Table 10. Analysis of variance summary table of time taken to read the story by groups receiving the reconstruction test.

Source	df	MS	F
Versions	2	265.46	13.85***
Error within	57	91.37	
Total	59		

***$p<.001$

among the three groups. The Tukey (a) Test revealed that all groups differed significantly ($p < .01$) from each other. It must be pointed out, however, that an analysis of variance was used for the reconstruction data, in spite of the rather marked differences in variances. The decision to use such an analysis was based on the results of the Norton study (Lindquist, 1953) in which it was concluded that there is a small effect of marked heterogeneity of variance which can be compensated for by using a slightly higher level of significance. Since the above *F* value was significant beyond the .001 level, it was assumed that, though the actual level was somewhat lower, the groups did differ significantly from each other.

An estimate of the reading rate for each subject was computed by dividing the total number of words contained in his assigned version by the total number of minutes required to read the version. Table 11 presents the mean number of words read per minute for the nine groups.

Table 11. Mean number of words per minute read and standard deviation for each of the nine groups.

Recall Method		Version		
		A	B	C
Set Relations	Mean	88.86	75.40	46.53
	SD	23.18	32.72	23.04
Multiple Choice	Mean	93.26	70.40	55.21
	SD	32.55	17.99	14.49
Reconstruction	Mean	91.56	71.29	59.34
	SD	72.41	23.44	25.20

Separate 1 x 3 analysis of variance was performed on each of the recall methods. Table 12 presents the results of the analysis of reading rates for the groups receiving the set relations test. Individual comparisons indicated that subjects receiving versions A and B read significantly faster ($p < .01$) than subjects receiving version C, but the former two groups did not differ significantly from each other.

The analysis of variance of reading rate for the multiple choice recall method also showed significant differences among the groups receiving the different versions. Table 13 presents the results of this analysis. Individual comparisons indicated that subjects receiving version A read significantly faster ($p < .01$) than subjects receiving versions B and C. There was no difference between the two latter versions.

Table 12. Analysis of variance summary table of words per minute for groups receiving the set relations test.

Source	df	MS	F
Versions	2	9,746.37	12.28***
Error within	60	793.49	
Total	62		

***$p < .001$

Table 13. Analysis of variance summary table of words per minute for groups receiving the multiple choice test.

Source	df	MS	F
Versions	2	7,256.09	13.77***
Error within	54	526.87	
Total	56		

***$p < .001$

The 1 x 3 analysis of variance of reading rates for the groups receiving the reconstruction method, on the other hand, yielded a nonsignificant F ratio ($F = 2.48$, df = 2/57, $p < .05$). However, because of the extreme variance associated with the version A group, the Kruskal-Wallis was also used to analyze the reading rates for the reconstruction groups. The resulting H value of 7.73 was significant at the .05 level. The Mann-Whitney U was then used to make individual comparisons. Results of the individual comparisons indicated that subjects read version C at a significantly slower rate than version A (U = 116, $p < .05$). None of the other comparisons was significant.

Set Relations Data

Table 14 presents the results of an item analysis of the set relations test for immediate recall. It must be pointed out, however, that the number of subjects within the three versions is quite limited for meaningful item analysis (n = 20, 23, and 23 for versions A, B, and C respectively). Since it is generally held that approximately 50 subjects is the minimum number for meaningful item statistics, the statistics in this analysis may be rather unstable. Nevertheless, it appears that the items are near the recommended values in difficulty and discrimination.

Table 14. Results of the item analysis for the 20 set relations items.

	Version		
Item Statistics	A	B	C
Mean item difficulty	.41	.38	.40
Mean item discrimination	.45	.36	.41
Mean point biserial correlation	.37	.39	.37
Kuder-Richardson #20	.67	.63	.69
Standard error of measurement	2.03	1.86	1.97

Ebel (1954) recommends that items be in the mid-range of difficulty (40 to 70 percent). Table 14 indicates that the mean item difficulty is very near 40 percent for the three groups. Ebel also recommends that the items be above .30 in discrimination. All mean item discrimination values were above this minimal value.

The mean point biserial correlation measures the relationship between performance on the items and total test score. For versions B and C, there are significant relationships between these two measures ($t = 1.94$, $p < .05$, and $t = 1.82$, $p < .05$ respectively). For version A, the t value of 1.69 approaches the .05 level but does not exceed it. One disturbing aspect of the item analyses was the rather low reliability coefficients yielded by Kuder-Richardson #20. A possible factor influencing these correlations might have been the relatively small number of items in the set relations test.

Table 15 presents the means and standard deviations for the 12 dependent variables derived from the immediate recall set relations test. Table 16 presents the data for the same variables from the delayed recall test.

Table 15. Means and standard deviations for the 12 dependent variables on the immediate recall set relations test.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Nested Before the Battle	3.32	1.16	2.86	1.42	3.41	1.30
Nested After the Battle	2.74	1.19	2.23	1.15	2.41	1.53
Nested Total	6.11	1.73	5.05	1.68	5.82	2.28
Disjunctive Before the Battle	3.26	1.28	3.82	1.09	3.59	1.14
Disjunctive After the Battle	3.58	1.39	3.82	1.18	3.64	1.09
Disjunctive Total	6.84	2.29	7.64	1.81	7.23	1.85
Total Before	6.63	1.77	6.68	1.98	7.00	1.80
Total After	6.32	1.38	6.09	1.77	6.05	2.04
Grand Total	12.95	2.64	12.73	2.88	13.05	3.02
S Score Before	10.00	1.70	9.05	1.59	9.82	1.65
S Score After	8.84	2.04	8.41	1.47	8.77	1.72
Total S Score	18.95	2.99	17.45	1.95	18.55	2.84

Separate 1 x 3 analyses of variance were computed for each of the twelve dependent variables in Tables 15 and 16. None of the F values was significant, indicating that performance on the set relations test was comparable regardless of the original treatment version read. No differences were observed among the three treatment versions on either the immediate or delayed recall test. Analyses of covariance were also performed on the same data, adjusting for reading achievement and IQ, each separately and also combined. Again, none of the resulting F values was significant. In fact, the analyses of covariance did not show increased precision. This suggests that perhaps reading achievement and IQ were not correlated with criterion performance or there was not a linear relationship between these variables and the dependent variables.

Table 16. Means and standard deviations for the 12 dependent variables on the delayed recall set relations test.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Nested Before the Battle	3.00	1.20	2.77	1.85	2.91	1.51
Nested After the Battle	2.16	1.39	1.96	1.21	1.96	1.21
Nested Total	5.16	1.98	4.73	2.35	4.86	2.15
Disjunctive Before the Battle	3.26	1.24	3.41	1.37	3.23	1.19
Disjunctive After the Battle	3.42	1.17	3.50	1.14	3.73	1.24
Disjunctive Total	6.74	2.16	6.91	1.90	6.96	2.19
Total Before	6.26	1.59	6.27	2.35	6.14	1.73
Total After	5.58	1.43	5.46	1.71	5.68	1.49
Grand Total	11.84	2.27	11.73	3.08	11.82	2.84
S Score Before	9.58	1.87	9.36	2.26	9.68	2.10
S Score After	8.90	2.23	8.46	1.63	8.23	1.95
Total S Score	18.47	3.69	17.77	2.99	17.91	3.28

The set relations were also scored as in Dawes' study by assigning each subject an s-score which is computed by subtracting the number of pseudo-discriminations (nested errors) from the number of overgeneralizations (disjunctive errors). In order to avoid negative values in the analysis of variance of the s-scores a constant of 10 was added to each score. The sign test was then used to determine whether subjects had a tendency to make more overgeneralizations than pseudo-discriminations. Table 17 presents the number of subjects who had positive s-scores (more overgeneralizations) and the number of subjects who had negative s-scores (more pseudo-discriminations) on the immediate and delayed recall tests. The results indicate that for

Table 17. Number of subjects within each version receiving positive and negative s-scores on the immediate and delayed recall tests.

Time of Recall	Version A	 B	 C
Immediate	+4 -13*	+1 -18**	+5 -5*
Delayed	+5 -11	+5 -14	+4 -15*

*$p < .05$, two-tailed
**$p < .01$, two-tailed

immediate recall, regardless of version, subjects made significantly more pseudo-discriminations than overgeneralizations. However, for delayed recall, only the subjects who read version C made significantly more pseudo-discriminations.

Multiple-Choice Data

The data from the multiple choice test were also submitted to an item analysis. Table 18 presents the results of the item analysis for the immediate recall test. Again it must be noted that these results may be unstable since the number of subjects is under 50 (N = 19, N = 21, and N = 22 for versions A, B, and C respectively). Though the mean item difficulty in version A falls short of the mid-range (40 to 70 percent), the mean item difficulty for versions B and C falls within this recommended range. Also the mean item discrimination is well above the recommended value of .30 in all versions. The significant point biserial correlations for versions B and C (t = 2.02 and t = 2.13 respectively) indicate that there is a relationship between a student's performance on the separate items and his total test score. The t value for version A, however, was not significant at the .05 level. In contrast to the set relations test, the Kuder-Richardson #20 coefficients indicate a moderate degree of reliability for the multiple choice items.

Table 19 presents the means and standard deviations for the total number of correct responses, number correct on the noncommon items, and number correct on the common items in immediate recall. The same data are presented in Table 20 for the delayed recall test. Separate 1 x 3 analysis of variance was performed on each of the three dependent variables for the immediate recall test and for the delayed recall test. All individual comparisons were again made by the Tukey (a) Test.

Table 18. Results of the item analysis for the 39 multiple choice items.

Item Statistics	Version A	B	C
Mean Item Difficulty	.29	.47	.48
Mean Item Discrimination	.39	.49	.53
Mean Point Biserial Correlation	.38	.42	.43
Kuder-Richardson #20	.86	.88	.89
Standard Error of Measurement	2.46	2.65	2.63

Table 19. Means and standard deviations for the three dependent variables on the immediate recall multiple choice test.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Total Number Correct	28.63	6.05	23.41	6.30	21.52	7.03
Number Correct on Noncommon	10.32	2.41	6.18	2.04	6.33	2.39
Number Correct on Common	18.32	4.16	17.24	4.89	15.19	5.16

Table 20. Means and standard deviations for the three dependent variables on the delayed recall multiple choice test.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Total Number Correct	27.32	7.70	23.18	5.46	18.19	9.43
Number Correct on Noncommon	9.26	2.88	6.50	2.03	5.00	3.10
Number Correct on Common	18.05	5.42	17.00	3.89	13.10	6.99

Table 21.presents the summary of the analysis of variance for the total number correct on immediate recall. The results indicated a significant effect due to the three treatment versions. Individual comparisons showed that subjects receiving version A performed significantly ($p < .01$) better than subjects receiving versions B or C. There was no difference between the B and C versions.

Table 21. Analysis of variance summary table for total correct on the immediate recall multiple choice test.

Source	df	MS	F
Versions	2	265.18	6.28**
Error within	54	42.26	
Total	56		

**$p < .01$

Table 22 presents the results of the 1 x 3 analysis of variance for the noncommon items. Again, a significant difference was obtained. Individual comparisons

Table 22. Analysis of variance summary table for number of noncommon items correct on the immediate recall multiple choice test.

Source	df	MS	F
Versions	2	104.13	19.71***
Error within	54	5.28	
Total	56		

***$p < .001$

paralleled the results obtained for total number correct. Version A differed significantly ($p < .01$) from versions B and C, while B and C did not differ significantly from each other.

A 1 x 3 analysis of variance on the number of correct responses for the common items revealed no significant differences among the three versions on immediate recall (_F_ = 2.22, _df_ = 2/54, $p < .12$).

On the delayed recall multiple choice test, a 1 x 3 analysis of variance of total correct responses revealed a significant difference ($p < .01$) among the three versions. Table 23 presents the results of this analysis.

Table 23. Analysis of variance summary table for total correct on the delayed recall multiple choice test.

Source	df	MS	F
Versions	2	417.85	6.79**
Error within	54	61.52	
Total	56		

**$p < .01$

Individual comparisons revealed that subjects who read version A scored significantly higher ($p < .05$) than subjects who read version C. None of the other individual comparisons was significant.

Analysis of the noncommon items on the delayed recall multiple choice test also revealed a significant effect among the versions. A summary of this analysis is presented in Table 24. Individual comparisons showed that subjects who read version A did significantly better ($p < .05$) than those who read versions B or C. There was no difference between versions B and C.

Table 24. Analysis of variance summary table for number correct on noncommon items on the delayed recall multiple choice test.

Source	df	MS	F
Versions	2	92.22	12.11***
Error within	54	7.62	
Total	56		

***$p < .001$

Analysis of variance of common items correct revealed a significant ($p < .02$) difference among the groups. This analysis is summarized in Table 25.

Table 25. Analysis of variance summary table for number of common items correct on the delayed recall multiple choice test.

Source	df	MS	F
Versions	2	136.90	4.23*
Error within	54	32.38	
Total	56		

*$p < .05$

Individual comparisons revealed that subjects who read versions A and B made significantly ($p < .05$) more correct responses than subjects who read version C. However, subjects reading versions A and B did not differ significantly from each other.

Reconstruction Data

Table 26 presents the means and standard deviations for the 21 dependent variables developed for the purpose of assessing the subjects' immediate written reconstructions of the original passages.

Separate 1 x 3 analyses of variance were computed in order to determine whether subjects receiving the three versions differed on these variables. Of the 21 analyses, only one yielded a significant *F* value. This analysis was based upon the number of noun modifiers used in the reconstructions. The summary of this analysis is presented in Table 27. While the probability level of an *F* value equal to 4.07 is approximately .02 (*df* = 2/57), the actual probability level is somewhat greater due to the fact that there was heterogeneity of variance. An *F* max test yielded an *F* value of 4.88 which exceeded the critical value of 3.06. Therefore, if the usual practice of doubling the actual probability value is followed, the probability is nearer the .04 level. Individual comparisons by means of the Tukey (a) Test indicated that subjects reading version [illegible] used significantly ($p < .05$) fewer noun modifiers than those reading version A. All other comparisons were nonsignificant.

Table 27. Analysis of variance summary table for noun modifiers on the immediate recall reconstruction task.

Source	df	MS	F
Versions	2	128.77	4.07*
Error within	57	31.63	
Total	59		

*$p < .05$

Table 28 presents the means and standard deviations for the 21 dependent variables on the delayed recall reconstruction task. Separate 1 x 3 analyses of variance were computed for each variable. Of the 21 analyses, five yielded significant *F* values. The three groups differed in the total

Table 26. Means and standard deviations for 21 variables from the immediate recall reconstruction task.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Total Sentences	11.55	5.92	12.15	6.84	9.05	8.28
Average Words per Sentence	11.47	4.59	12.32	3.73	12.38	3.77
Kernel Elements	29.20	16.78	33.95	21.72	23.65	15.20
Exact Match	18.55	14.50	24.40	16.23	16.45	12.33
True Inferences	5.35	4.55	4.70	6.04	2.90	3.37
Total Words	149.15	105.02	165.45	129.60	102.40	80.52
Nouns	36.70	21.86	40.85	31.76	28.15	19.46
Verbs	25.40	18.17	29.05	21.14	18.45	15.49
Adjectives	10.85	7.33	11.15	10.26	7.25	4.75
Adverbs	7.10	7.17	6.95	6.49	4.00	3.34
Pronouns	11.00	10.82	12.50	9.94	6.50	7.40
Prepositions	12.90	10.29	14.05	11.41	9.55	7.01
Conjunctions	10.00	8.19	12.25	12.09	7.30	6.69
Determiners	11.55	8.15	14.85	13.18	9.20	6.55
Noun Modifiers	7.55	7.63	5.45	4.97	2.50	3.46
Expletives	.75	.79	1.00	1.12	.40	.59
Possessive Pronouns	2.50	2.54	3.60	3.73	2.55	3.30
Possessive Nouns	1.25	1.58	1.65	3.15	1.40	1.46
Negative Adverbs	1.15	1.46	1.60	1.63	1.35	1.60
Different Key Words	24.00	14.05	28.35	18.56	19.85	12.81
Total Key Words	52.15	34.81	53.65	39.76	34.05	25.47

Table 28. Means and standard deviations for 21 variables from the delayed recall reconstruction task.

	Version					
	A		B		C	
Dependent Variable	Mean	SD	Mean	SD	Mean	SD
Total Sentences	17.30	9.49	12.85	9.71	11.15	4.37
Average Words per Sentence	12.58	3.42	12.23	3.97	12.10	3.63
Kernel Elements	43.45	23.09	31.50	22.64	28.60	13.48
Exact Match	30.95	19.09	21.80	18.11	20.15	12.23
True Inferences	6.95	5.38	5.50	5.05	4.30	3.64
Total Words	215.10	126.16	153.50	111.74	135.70	61.74
Nouns	54.05	30.11	36.75	25.09	36.05	15.65
Verbs	37.85	22.47	26.50	19.66	23.35	11.02
Adjectives	15.45	12.33	10.75	7.99	9.90	7.32
Adverbs	11.35	9.46	7.80	7.98	3.90	2.85
Pronouns	15.80	12.06	12.15	10.65	9.25	6.27
Prepositions	18.05	11.87	13.10	11.00	10.80	7.47
Conjunctions	14.45	10.61	11.55	10.31	9.10	5.36
Determiners	18.65	12.42	11.65	9.46	10.50	6.06
Noun Modifiers	7.85	5.44	6.00	6.59	4.50	4.10
Expletives	1.40	1.14	.90	.92	.35	.59
Possessive Pronouns	3.55	3.92	3.50	2.20	2.10	2.92
Possessive Nouns	1.30	1.69	2.25	1.83	1.20	1.54
Negative Adverbs	1.55	1.79	1.40	2.03	1.50	1.43
Different Key Words	35.85	17.99	26.25	16.50	25.85	15.31
Total Key Words	68.45	36.19	49.50	37.23	47.35	20.42

number of words used in the reconstruction of the story. Table 29 presents the summary of this analysis. The F max yielded a value of 4.18 which exceeded the critical value of 3.06. Since there was heterogeneity of variance, the actual probability level was again nearer the .04 level. Individual comparisons indicated that the subjects who read version A used significantly ($p<.05$) more words than those who read version C. All other individual comparisons were not significant.

Table 29. Analysis of variance summary table for total number of words used on the delayed recall reconstruction task.

Source	df	MS	F
Versions	2	34719.20	3.23**
Error within	57	10738.54	
Total	59		

**$p<.01$

Analysis of the number of nouns used in the reconstructions also yielded a significant F value. This analysis is summarized in Table 30. These results,

Table 30. Analysis of variance summary table for number of nouns used on the delayed recall reconstruction task.

Source	df	MS	F
Versions	2	2079.27	3.50*
Error within	57	593.68	
Total	59		

*$p<.05$

however, must be interpreted with caution since heterogeneity of variance was again present (F max = 3.70, critical value = 3.06) and the obtained F value was significant at only the .05 level. Nevertheless, individual comparisons were performed. Subjects receiving version A used significantly ($p < .05$) more nouns than those receiving version C. None of the other comparisons was significant.

Table 31 presents the summary of the analysis of variance on the number of adverbs used in the subjects' reconstructions. The F max test again

Table 31. Analysis of variance summary table for number of adverbs used on the delayed recall reconstruction task.

Source	df	MS	F
Versions	2	277.72	5.17**
Error within	57	53.71	
Total	59		

**$p < .01$

indicated marked heterogeneity of variance among the three groups (F max = 11.04, critical value = 3.06). But since the obtained F value was significant at the .01 level, doubling this value still resulted in a rather low probability value (.02). Individual comparisons again indicated that subjects receiving version A used significantly more adverbs in their reconstructions than those receiving version C. None of the other individual comparisons was significant.

Table 32 presents the summary of the analysis of variance on the number of determiners. The F max test yielded an F value of 4.19 which was significant at the .01 level. In spite of the heterogeneity of variance, individual comparisons were performed. The results indicated that subjects in group C used significantly fewer noun determiners in their reconstructions than subjects in group A. None of the remaining comparisons was significant.

Table 33 presents the summary of the analysis of variance on the number of expletives. Again the F max test was significant (F max = 3.78, $p < .05$). However, individual comparisons were performed and indicated that subjects in group C used significantly (.01) fewer expletives than subjects in group A. No other comparisons were significant.

Table 32. Analysis of variance summary table for number of determiners used on the delayed recall reconstruction task.

Source	df	MS	F
Versions	2	389.15	4.16*
Error within	57	93.51	
Total	59		

$*p < .05$

Table 33. Analysis of variance summary table for number of expletives used on the delayed recall reconstruction task.

Source	df	MS	F
Versions	2	5.52	6.67**
Error within	57	.83	
Total	59		

$**p < .01$

DISCUSSION

Analysis of the number of minutes required to read the versions showed that, as expected, less time was required to read the telegraphic than the full text or condensed versions. With the exception of the set relation groups, the short telegraphic version required significantly less time to read than the medium telegraphic version. In all three recall conditions, the medium and telegraphic versions were read significantly faster than the traditional version.

Examination of reading rates (wpm) revealed some interesting and unexpected results. The analysis of wpm among the set relation groups revealed that there was no difference in average reading rates between the traditional and medium telegraphic versions (88.86 wpm compared to 75.40 wpm), but there was a significant difference between these two versions and the short telegraphic version (46.53 wpm). Comparison of reading rates among the multiple choice groups indicated no difference between the medium and short telegraphic versions, but both groups read at significantly ($p < .01$) slower rates than the traditional version group. While the 1 x 3 analysis of variance was not significant for the reconstruction groups, the non-parametric analyses were. Individual comparisons of the reconstruction data revealed that subjects read version C at a significantly slower rate than version A. Version B was read at an intermediate rate and did not differ significantly from either versions A or C.

The unexpected finding, which was most obvious among the set relation groups, was the marked reduction in reading speed for the group receiving the short telegraphic version. This version was read at approximately one-half the rate of the traditional version. While elimination of much descriptive and narrative material resulted in a significant savings in time, there was a reduction in reading rates for the shorter and informationally more compact version.

Two possible reasons are suggested for the rather dramatic decrease in wpm for the short telegraphic version. First, the style of version C, which was essentially an outline form, may have been relatively unfamiliar to these subjects. Characteristically, blind children have no experience in seeing written "telegraphic" information on chalkboards or in equivalent tactual form, as their teachers lecture on a topic in class. Added to this is the fact that their teachers must practice certain time economies to compensate for the additional time they require to read and write in Braille, or listen to material read to them: therefore, they require little outlining of material read. And since the blind children in this study were just becoming proficient in the use of slates and stili, it may be further hypothesized that they were inexperienced in classroom notetaking, and hence in reviewing "telegraphic" information for test taking purposes. Thus the style may have caused them to reduce their normal reading speed. Perhaps training with this type of material would have produced a lesser reduction in reading rate. Second, the decrease in wpm may be attributable to the compactness of information contained in the C version. This version was so designed that all information contained in it was necessary for a complete understanding of the passage. In order to read the passage with a satisfactory degree of understanding, subjects may have found it necessary to decrease their normal reading speed. It may be that subjects attempt to maintain some optimal information processing rate which they will not voluntarily exceed.

No significant differences among the three versions were expected with respect to total number of correct responses on the set relations test since the number of set relations was the same for all versions. However, it was hypothesized that more overgeneralization errors would occur among subjects reading version A than among subjects reading version C. Contrary to this hypothesis, the results of the analysis of variance revealed no significant differences among the mean s-scores. These results indicated that all groups made similar types of errors.

Dawes' data and theorizing provided the basis for predicting a greater number of overgeneralization errors among subjects reading version A. His data indicated that overgeneralization errors were more common than pseudo-discrimination errors. Because overgeneralization errors result in a reduction of categories or sets in the passage and because of the limitation in human memory, it was expected that subjects would tend to overgeneralize in order to reduce the informational load. This tendency was expected to increase for the longer passages. However, it may be argued that, though the passages differed in total length, they did not differ in the total number of set relations. The tendency towards overgeneralization may have been related only to the number of set relations contained in the passage and not affected by sheer length. Not only were there no differences in the number of overgeneralization errors among the three versions, but there were significantly more pseudo-discrimination errors. Inspection of Table 17 reveals that four of the six comparisons indicated that significantly more subjects received negative s-scores than positive scores.

The most disturbing aspect of the set relation items was their apparent difficulty. Table 15 presents the mean number of total correct responses for the twenty item set relations test. The mean number correct for the A, B, and C version groups were 12.95, 12.73, and 13.05, respectively. An expected chance score on this test is 10.00. In fact, when each of the above means was analyzed to determine whether it was significantly above chance, none of the resulting $\underline{z}$ scores was significant. These results were entirely unexpected inasmuch as the items had been pretested on two regular classes of normal seeing children in grades five and six. While the normal seeing fifth grade subjects had difficulty with the items, the sixth grade subjects responded significantly above chance. On the basis of these results it was assumed that few blind subjects would experience difficulty in obtaining scores above chance. Such was not the case. The fact that significantly more subjects made pseudo-discrimination errors than overgeneralization errors may be due to a response bias rather than to any type of cognitive distortion. Subjects may have preferred to respond to "some" type answers rather than to the "all" or "none" types. Consequently, although the data obtained from the normal seeing subjects also indicated that significantly more pseudo-discrimination errors were made, the chance performance of the blind subjects made it impossible to assess the effectiveness of the treatment versions or to assess type of cognitive distortion.

Analyses of the multiple choice data did reveal differences among the three treatment versions. For immediate recall, the results of the analysis of variance on the common items (items answered in all three versions) showed no significant difference among the groups. On the noncommon items, however, subjects who read version A performed significantly better than those who read versions B or C. This is not surprising since version A contained the answers to the noncommon items whereas versions B and C did not. Moreover, when performance on total items (noncommon and common items combined) was examined, the same differences were found. The differences on the total items were largely due to the superior performance of group A on the noncommon items. It appears that while the information relating to the noncommon items was not essential for a thorough understanding of the story. it was learned and recalled by the subjects.

The results of the delayed recall multiple choice test were similar to the immediate recall test. Subjects who read version A performed significantly better than subjects reading versions B and C on the noncommon items. However, for total items, there was no difference between the A and B versions. Nevertheless, subjects reading version A performed significantly better than subjects reading version C.

Analysis of the delayed common items produced an unexpected result. Though there was no difference among the three groups on immediate recall, there was a significant difference on delayed recall. The groups reading version A performed significantly better than the group reading version C. Comparison of the data in Tables 19 and 20 reveals that while there was little change between immediate and delayed retention for versions A and B, there was a decrease for version C in the number of common items correct on the delayed recall task. It is unclear why there was differential forgetting among the three groups on the common items. Blind children lack actual, visual experiences (such as may be gained through pictures and television) that may be necessary to "dress" written skeletal outlines with meaning. The material with which they dealt in this study involved wars and unfamiliar people, tools, ideas, and places--all of which they have been previously unable to "see" in pictorial form. They lack the visual imagery of the interrelating conflicts in the story, a fact which may have forced them to reduce reading speed. Perhaps, the relative lack of supplementary details in the short telegraphic version contributed to the decrement in delayed recall. While the common items could be answered on the basis of the information contained in each of the three versions, the supplementary information in the longer versions may have provided a more salient context for the recall of the common items. Whatever the reason for the decrement in delayed recall among version C subjects, there was practically no forgetting among subjects reading versions A and B. Regardless which dependent variable is considered, inspection of Tables 19 and 20 reveals surprisingly little forgetting over the one week interval for the A and B versions.

Analysis of the reconstruction data revealed few significant differences among the three versions. This is especially true for the immediate recall data in which a significant difference was found in only one of the 21 dependent variables, that is, the number of noun modifiers. Subjects reading version C used significantly fewer noun modifiers than those reading version A. However, this result is not necessarily indicative of a telegraphic writing among the version C reconstructions. Rather, it is most likely due to the fact that version A contained almost three times as many noun modifiers as version C. The finding that there were no significant differences among the three groups in total number of sentences or average words per sentence would suggest that the version C subjects did not tend to write in a telegraphic manner to any greater extent than the other groups.

Results of the delayed recall reconstruction data revealed a greater number of significant differences among the three versions. Of the 21 analyses of variance, five yielded significant F ratios. Analysis of the average number of total words used in the reconstructions indicated that version C subjects' reconstructions were 135.70 words in length, version A subjects' reconstructions were 215.10 words in length. This represents a 37% increase in the length of version A subjects' reconstructions over version C subjects' reconstructions. The greater number of nouns used in the reconstructions accounts to some extent for the longer version A reconstructions. Version A subjects employed significantly ($p < .05$) more nouns than version C subjects. The difference between version A and version B approached significance (critical difference = 17.69, obtained difference = 17.30), but this is not surprising since version A contained 409 nouns compared to 141 nouns in version C. The greater number of nouns in version A was due to a greater degree of repetition and the introduction of extraneous information. Evidently these two factors contributed to the greater use and perhaps availability of these words during delayed recall.

The number of adverbs used during delayed reconstruction by version C subjects was significantly less than the number used by version A subjects. However, version B subjects differed neither from version A nor version C subjects. These results indicate a tendency among version C subjects to include less descriptive material in their delayed reconstructions. Since version A contained 5 times as many adverbs as version C, the difference between subjects receiving the two versions is not entirely unexpected. What is unexpected, however, is that this difference should occur in delayed reconstruction and not in immediate reconstruction. While there was little difference between the number of adverbs used for immediate and delayed reconstructions for group C, groups A and B employed more adverbs in delayed than in immediate reconstruction.

Likewise, although there were no differences among the groups on the number of determiners used in immediate reconstruction, there were differences in delayed reconstruction. Again, the difference was only between groups A and C. As in the analysis of adverbs, group A used substantially more determiners in delayed recall than in immediate recall. There was little change for the other groups. In fact, version B subjects used fewer determiners in delayed reconstruction than in immediate reconstruction. Inspection of Table 2 reveals 17 times as many determiners in version A than in version C. Therefore, it is not entirely surprising that version C subjects used determiners less frequently. Again though, it is not clear why this difference was observed in delayed reconstruction and not in immediate reconstruction.

Although the analysis of the number of expletives indicated a significant difference between groups A and C on the delayed recall reconstruction task, the data are not particularly meaningful in view of the relative infrequent occurrence of these items in the reconstructions. Table 27 reveals that version A subjects used an average of 1.40 expletives in their reconstructions while version B and C subjects used an average of .90 and .35 respectively. There was only a total of two expletives used in version A, none in version B, and one in version C.

With the exception of noun modifiers, the immediate recall reconstruction data revealed no differences among the three versions. The fact that there were no significant differences among the versions on number of kernel elements and exact matches is noteworthy in view of the fact that version C was read in one-third the time as that required for version A. That is, version C subjects appeared to reconstruct the story as adequately as version A subjects. However, a greater number of significant differences were noted among the versions in the delayed reconstructions. While there were no significant differences among the groups on number of kernels and exact matches, there were on total words, nouns, adverbs, determiners and expletives. It appeared that version C subjects included less descriptive and narrative material in their delayed reconstructions than version A subjects. The lack of this type of material undoubtedly contributed to the shorter length of version C subjects' reconstructions.

For the most part, the results of all three recall conditions revealed little difference among the three versions with respect to the recall (either immediate or delayed) of the essential information contained in the passages. The one exception was the inferior performance of version C subjects on the common multiple choice items during the delayed recall task. However, the performance of the medium telegraphic group did not differ from the traditional group. In fact, none of the individual comparisons of the reconstruction data revealed any significant differences between the traditional and medium telegraphic versions. The differences were consistently between the traditional and short telegraphic versions. The unfamiliar style of the short telegraphic version undoubtedly contributed to these differences.

CONCLUSIONS

The results of this investigation suggest that telegraphic materials may be a more efficient way for braille readers to learn equivalent content of traditional text materials. While there were few significant differences among the three versions on the recall measures, there were significant differences among the three versions in the average number of minutes required to read the passages. To illustrate, the multiple choice groups required 19.23, 14.22, and 9.02 minutes to read the traditional, medium telegraphic, and short telegraphic versions respectively. Contrast these values with the number correct on the common multiple choice items: 18.32, 17.24, and 15.19 for the traditional, medium, and short telegraphic versions respectively. In short, braille readers in this study required 53 per cent less time to read version C than version A, while immediate recall was only 12 per cent less effective. These comparisons reveal the greater efficiency of the short telegraphic version and are typical of other such comparisons.

It must also be pointed out however, that subjects reading the traditional version did remember the extraneous narrative material contained in this version. An implicit assumption in the early formulation of this project was that since the extraneous narrative and descriptive material was not necessary for a complete understanding of the passage, this material would not be recalled. Such was not the case. Furthermore, the results of the delayed recall of the common multiple choice items suggested that this extraneous information may have provided a more salient context for the recall of these items.

A second quite explicit assumption was that rate of information input could be increased via telegraphic materials. This presumed that a blind child would maintain his same reading speed with telegraphic materials as with traditional materials. The data indicated approximately a 35-50 per cent reduction in wpm among the subjects reading the short telegraphic versions. Two possible factors may account for this reduction. The first may be that the subjects selected reading speeds which insured comfortable rates of information input and did not voluntarily exceed these rates. A second, and perhaps more plausible, interpretation may involve a familiarity factor. The unique style of the telegraphic materials may have caused a reduction in reading speed. The fact that reading rates were not reduced as much for the medium telegraphic version as they were for the short telegraphic version supports the latter interpretation. On the other hand, the reduction in wpm among subjects reading the medium telegraphic versions supports the former interpretation. Either interpretation may be tested rather easily. An auditory presentation of telegraphic and traditional materials would permit assessment of the first interpretation and familiarization training on telegraphic materials would permit assessment of the latter. It is quite possible that both factors influenced the results of this study.

For the most part, the results of this investigation are interpreted as supporting the feasibility of using telegraphic materials to increase the rate of learning of certain materials in braille. However, a shortcoming of this study is that it has not provided an operational definition of essential or kernel information which can be applied to existing materials. It is obvious that most materials are not amenable to a set relation analysis. The ultimate application of the telegraphic concept to existing learning materials is dependent upon the development of objective reduction rules whereby extraneous information may be systematically eliminated from traditional materials. It may be possible, for example, to develop rules whereby certain parts of speech are systematically discarded in much the same manner as are speech segments in the time compression technique. Further research is needed to determine the kinds of objective reduction rules which are possible and the effect of such reduction upon comprehension of existing materials.

In summary, this investigation has demonstrated that it was possible to rewrite traditional materials in such a fashion that low information words, phrases and sentences could be eliminated without destroying the essential information in the materials. Furthermore, the learning and retention of the important information in such telegraphic materials was in almost all comparisons comparable to the learning and retention of the same information presented in traditional style. Although these results may have implications for the learning of prose materials by any learner, they suggest that more efficient learning materials may be developed for blind children. One alternative to the relatively slow methods of braille material presentation commonly employed in the education of visually impaired children is the preparation of informationally compact telegraphic materials. Braille material presented in a telegraphic style appears to be at least as efficient as material presented in conventional style, and requires less time to learn.

SUMMARY

The major objective of this investigation was to examine the ability of blind children to comprehend braille prose material presented in two condensed styles, "medium telegraphic" and "highly telegraphic" forms. It was hypothesized that braille material presented in telegraphic style to blind children would result in increased rates of comprehension in comparison to braille material presented in the usual traditional form.

The feasibility of developing telegraphic learning materials was based upon the assumption that prose found in conventional textbooks contains many words and word sequences which are unnecessary for the comprehension of the material. Telegraphic materials were developed by eliminating unimportant words, phrases, and sentences from traditional textual material.

A fictional story concerning two warring African nations was written in full prose, traditional style, resulting in a 1620-word passage. In order to operationally define the important information in the passage, the story was written so that the central ideas of the passage were analyzable in terms of basic set relations. Important information was defined as material which described the set relations. Unimportant information was defined as narrative or descriptive material which was unrelated to the set relations. Next, a medium telegraphic condensation of the same story (947-word passage) was written in traditional sentence and paragraph form, but with a 42 per cent reduction in narrative and background material of the original passage. And finally, a highly condensed version of the story was written in which the total number of words was reduced to 455. The style of this passage was similar to that of a telegram, and achieved a 72 per cent reduction of the original passage.

While there was a marked reduction in the total number of words in the two telegraphic passages, the essential information pertaining to the set relations was the same in all three versions. The greatest absolute reduction among the telegraphic versions was in nouns and verbs, while the greatest percent reduction was in noun determiners, pronouns, prepositions and adverbs.

A total of 210 braille readers in grades six, seven, eight, and nine were tested. With the exception of 12 subjects, all attended state residential and day school classes for visually impaired children and youth. All subjects had received formal braille instruction for four years or more.

Approximately one-third of the subjects read the traditional passage presented in braille, one-third read the medium length telegraphic version in braille, and one-third read the short telegraphic version in braille. Within each group assigned to a particular version, there were three sub-groups assigned to one of three recall conditions: recall of set relation items, recall of multiple choice items, and written reconstruction of the passage. Recall was measured immediately after reading the assigned version and again one week later. Each subject was retested in the same recall condition as that to which he was originally assigned.

The results of this investigation revealed that subjects reading the medium and short telegraphic versions required significantly less time than subjects reading the traditional version. However, the reading rate (wpm) was significantly less for subjects reading the short telegraphic version than for those reading the traditional version. Analysis of the comprehension data revealed few significant differences among the three groups on either immediate or delayed recall. Nevertheless, there were consistent differences among the groups in the recall of the narrative and descriptive material. While the subjects reading the telegraphic versions had practically no contact with this material, the subjects reading the traditional version containing the descriptive material were able to recall it. Few significant differences were observed among the three groups on the 21 dependent variables developed for the purpose of analyzing subjects written reconstructions. For immediate recall, the only significant difference was in the number of noun modifiers. Subjects reading the short telegraphic version used significantly fewer noun modifiers than subjects reading the traditional version. For delayed recall, subjects reading the short telegraphic version used significantly fewer total number of words, nouns, adverbs, noun determiners and expletives than subjects reading the traditional version. In spite of these differences, there were no differences among the groups in the number of basic kernel information units recalled.

In general, the results of this investigation were interpreted as supporting the feasibility of telegraphic learning materials. The learning and retention of the important information in telegraphic materials was in almost all comparisons comparable to the learning and retention of the same information presented in traditional style. The ultimate application of the telegraphic concept to existing materials is dependent upon the development of objective reduction rules whereby extraneous information may be systematically eliminated from traditional materials. Further research is needed in order to develop such rules. Since most of the recall comparisons showed no significant differences, the preparation of informationally compact telegraphic material may be one alternative to the relatively slow methods of braille material presentation commonly employed in the education of visually impaired children.

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Appendix A

Traditional Version of the Story (A)

In the year 1800 on the continent of Africa, two unfriendly nations existed, the nation of Mambo and the nation of Yam. The Nile River separated these two nations. They often fought wars over business, with Yam being the richer of the two. Yam was rich in wood, ivory, leopard skins, ostrich feathers and eggs, baboons, and dogs. Yam traded these goods and foods all over the continent and became very wealthy.

King Koko, the leader of the military minded nation of Mambo, began to make plans for the defeat of Yam. Koko was a military man and most of his subjects were brave, strong, expert warriors; no Mambo Citizens were merchants. They liked war so much that they often would fight another tribe's battles for money and glory. They never lost.

However, Koko was getting old and his body was tired and ached from his numerous war wounds. If he defeated Yam, he would become very rich and he would control thousands of people. Koko then could rest his battle weary body and live in luxury enjoying very much personal wealth and power; he would be the most powerful ruler on the continent.

King Koko felt that the time for war against Yam was suitable because his Mambo warriors did not like King Lester of Yam. Lester was a popular ruler whose subjects loved him; he was an excellent hunter and warrior; he was rich and handsome. Koko knew that his warriors would welcome the chance to defeat Lester. Their dislike and jealousy of Lester plus their greed for the wealth of Yam was more than enough reason for them to fight a war against Yam land.

However, there was a small band of expert Mambo warriors who knew about Koko's plans and they did not like them. These Mambo warriors compared Koko to Lester and they decided Lester was the kind of king they would like to serve and they welcomed the chance to be traitors to Koko. As a result, they were secretly meeting with a small group of Yam merchants who agreed to pay them money and supply them with weapons so they could help defend Yam. These merchants also wanted to be trained as warriors. Thus the Pro Lester Union consisted of a small number of Yam merchants and a small number of traitor Mambo warriors. It was a rather odd looking group with a small number of strong, fierce looking warriors trying to teach weak, fat looking merchants how to throw spears, shoot arrows, and chop up an enemy with an axe. The training periods never lasted more than twenty minutes because the merchants became very tired and needed to rest. Nevertheless, these men were serious about becoming warriors and they vowed to fight and die to the last man for good King Lester, their noble ruler.

Meanwhile, in Yam land, life was peaceful and happy as usual for most of the people. Lester and his followers never thought much about war because they were too busy trading the plentiful goods of Yam all over the continent. Most of Lester's followers were merchants; none of them were expert warriors. This business made them wealthy and happy.

Thus the stage was set. King Koko prepared his army for war and the most important preparation was the worship of Solmambo, the sun-god. The witch doctor, robed in white, looked directly into the sun at high noon and chanted in a low voice. All the warriors had to do the same and any warrior who fainted from the heat or who could not look into the sun was killed. This happened because the witch doctor told the king that the sun-god was giving him a sign as to who were the unworthy warriors; since they were unworthy and would not receive divine assistance in battle, the witch doctor killed them. He executed fifty warriors that afternoon.

The Mambo warriors then painted their faces with the blood of goats; this gave them courage. Although this may have given the Mambo warriors courage, some historians believe that it did much to frighten the enemy. A blood streaked face with hate filled eyes screamed and charged for the kill. This could scare anyone!

Now that the warriors were ready to fight, they picked up their spears and climbed into their war canoes to paddle down the river to the land of Yam. It is interesting to point out that the paddles were also the spears of the warriors. These spears were medium length poles with wide iron tips that came to a very sharp point. These spears were heavy and well balanced. When thrown, it would fly straight to its target. This weapon was also a club in close fighting because of its heaviness. The wide iron tip had very sharp edges so it also was a sword or double edged axe. This one weapon was very valuable because of its many uses: a paddle, a spear, a club, a sword.

As the war canoes came near Yam, the lookouts of King Lester shouted the alarm. Immediately there was confusion and noise. There was the unusual sound of Yam musicians beating drums, blowing ram horns, and shaking rattles. They were also doing a native tribal dance. This religious ceremony was going to chase away any evil spirits lurking about who might hinder or harm Lester during the battle. All the Lester Followers, consisting of the Yam merchants and other Yam subjects and the Pro Lester Union, prepared to meet the invaders.

The traitor Mambo warriors who had joined with the Yam merchants to form an army came running (and some panting) to meet the invaders. Lester entered the battle with his camel cavalry. These warriors wielded sharp-edged heavy pieces of iron that could cut off an enemy's head with a single stroke. However, King Lester and his forces were losing the battle. One reason was the fact that the fat Yam merchant-warriors were no match for the tough expert warriors of Mambo. Lester's army was also small; he was outnumbered by five to one. King Lester's heavy iron swords were difficult to use whereas King Koko's spears could be used with ease in many different ways. Koko's weapon was simple and effective.

Nevertheless the battle continued with the battlefield being a mass of men, spears, camels, swords, screams, and blood. Lester decided that the only way he could win would be to fight Koko in personal combat and kill him. Lester saw Koko and charged at him with his sword so he could cut his head off. But before he could strike, Koko sent his spear into Lester's chest. Koko threw the spear so hard that it came out through Lester's back. After this the Yam warriors fled in terror; they became helpless cowards without their leader. Mambo had won the battle.

King Koko's toothless mouth widened into a big grin and he was proud of his victory. He now was the master of seven thousand prisoners, two hundred thousand cattle and sheep, and the business wealth of Yam. As a result of this victory the original social structure of Mambo remained the same with the largest number of Mambo Citizens still being expert warriors. This was necessary because Koko needed a large military force to keep the Yam inhabitants under control and to protect his new found wealth.

But what of Yam? After its defeat its social structure changed; all the people of Yam and the traitor Mambo warriors became slaves of King Koko. They no longer performed the same occupations as they had when they were free and happy, and now all their work was for their new ruler. The once prosperous people of Yam were now miserable slaves without any pride or satisfaction in their work.

However, there was an interesting legend which came out of this war. After King Koko killed King Lester, some of Lester's faithful subjects succeeded in rescuing his dead body and secretly burying it to prevent the traditional burning up of killed enemy leaders that the Mambo warriors liked to perform. These Yam subjects never revealed their deed but instead they claimed that some friendly spirits had taken the seriously wounded Lester away to safety so he could recover and return to free his people. This is known as the Lester Legend. It is no comfort to Koko that a rather sizable number of Yam slaves believe this legend and he is beginning to wonder about it himself. He feels certain that he killed Lester but his dead body has never been found.

But if Koko knew about the Freedom Group, he wouldn't worry about the legend so much. The Freedom Group is made up of some Legend Believers and the traitor Mambo warriors who fought for Lester but really don't believe the legend. This group is secretly hiding weapons in the jungle, keeping the Lester Legend alive, and planning for the overthrow of Koko. They are very active. From time to time Koko finds a skull in front of his hut or a dead Mambo warrior. Shipments of goods to other nations often never reach their destinations. Koko's food often contains poison; he lost fifteen food tasters in one week; needless to say he has a loss of appetite. Koko is grouchy, irritable, and suspicious. His relation with his troops is becoming unfriendly because he blames them for not keeping control of the slaves. He sometimes thinks they are plotting against him with the slaves. The future for Koko is not promising. Perhaps his victory was not so sweet after all.

* * * *

Now that you have finished reading the story, raise your hand.

Appendix B

Telegraphic Version of the Story (B)

In the year 1800 on the continent of Africa, two unfriendly nations existed, Mambo and Yam. The Nile River separated them. Yam was richer.

King Koko began to plan the defeat of Yam. Koko was a military man; most of his subjects were expert warriors; none were merchants. They liked war and often fought another tribes' battles for money and glory.

However, Koko was getting old. If Koko conquered Yam, he would be rich and control thousands of people; he could rest his body, live in luxury, enjoy personal wealth and power; and be the strongest ruler on the continent.

Koko felt the time for war against Yam was suitable because his Mambo warriors disliked King Lester of Yam. Koko knew his warriors would welcome the chance to defeat Lester and his followers because of their dislike and jealousy of Lester plus their greed for the wealth of Yam.

However, a small band of expert Mambo warriors disliked Koko's plans. These Mambo warriors compared Koko and Lester and Lester was the kind of king they wanted to serve; they would be traitors to Koko. As a result this small band of traitor Mambo warriors secretly met with a small group of Yam merchants who agreed to pay them money and supply them with weapons so they would defend Yam. The small group of Yam merchants also wanted to be trained as warriors. Thus, a small band of strong, fierce, traitor Mambo warriors and a small group of weak, fat merchants formed the Pro Lester Union.

Lester and his followers never thought much about war because they were too busy trading the plentiful goods of Yam all over the continent. Most of Lester's followers were merchants; none were expert warriors.

King Koko prepared his army for war and most important was the worship of Solmambo, the sun-god. The witch doctor looked directly into the sun at high noon and chanted; all the Mambo warriors did the same; any who fainted from the heat or looked away from the sun were killed. The witch doctor executed fifty warriors.. The Mambo warriors also painted their faces with goat's blood for courage.

Now that the Mambo warriors were ready to fight, they climbed into their war canoes and paddled down the river toward Yam. The paddles were also the spears of the warriors. These spears were heavy and well balanced; they could be used as clubs in close fighting due to their heaviness. The wide iron tips had very sharp edges so they could also be used as a sword or double edged axe.

When the war canoes approached Yam, Lester's lookouts shouted the alarm. Yam musicians beat drums, blew ram horns, and shook rattles while doing a native tribal dance. This religious ceremony was to chase away any evil spirits who might harm Lester during the battle. All the Lester Followers, consisting of all Yam merchants and other Yam subjects and the Pro-Lester Union prepared to meet the invaders.

King Lester lead his camel cavalry into the battle. However, Lester and his forces were losing the battle. The fat merchant warriors were no match for the tough expert Mambo warriors; Lester's army was outnumbered by five to one; Lester's cavalry wielded heavy iron swords which were difficult to use. Lester decided he could win only if he could fight Koko in personal combat and kill him. Lester charged at Koko with his sword but before he could strike, Koko sent his spear in Lester's chest with such force that it came out through Lester's back. Mambo had won the battle.

King Koko was proud of his victory; he was now the master of seven thousand slaves, two hundred thousand cattle and sheep, and the business wealth of Yam. The original social structure of Mambo remained the same with most of the Mambo Citizens still being expert warriors because Koko had to keep the Yam Citizens under control and protect his wealth. However, the social structure of Yam changed; all of the Yam people and the traitor Mambo warriors were now slaves of King Koko.

After King Koko killed King Lester, some of Lester's faithful subjects succeeded in rescuing his dead body and secretly burying it to prevent the traditional burning up of killed enemy leaders that the Mambo warriors liked to perform. These Yam subjects never revealed their deed but instead they claimed that some friendly spirits had taken the seriously wounded Lester away to safety so he could recover and return to free his people. This is known as the Lester Legend. It is no comfort to Koko that a rather sizable number of Yam slaves believe this legend and he is beginning to wonder about it himself. He feels certain that he killed Lester but his dead body has never been found.

But if Koko knew about the Freedom Group, he wouldn't worry about the legend so much. The Freedom Group is made up of some Legend Believers and the traitor Mambo warriors who fought for Lester but don't believe the legend. This group is secretly hiding weapons in the jungle, keeping the Lester Legend alive, and planning for the overthrow of Koko. From time to time Koko finds a skull in front of his hut or a dead Mambo warrior. Shipments of goods to other nations often never reach their destinations. Koko's food often contains poison.

Koko is grouchy, irritable, and suspicious. His relation with his troops is becoming unfriendly because he blames them for not keeping control of the slaves. He sometimes thinks they are plotting against him with the slaves. The future for Koko is not promising. Perhaps his victory was not so sweet after all.

* * * *

Now that you have finished reading the story, raise your hand.

Appendix C
Short Telegraphic Version of the Story (c)

In Africa, in 1800, the Nile River separated two unfriendly nations, Mambo and Yam.

- Mambo: ruled by old military man, King Koko, who planned to conquer Yam for its riches.
  - Most subjects were expert warriors; none were merchants.
    - Warriors fought other tribes' wars for money and glory and were greedy for Yam's riches.

But small group of expert Mambo warriors dislike Koko's plan, decided to be traitors and serve Lester.

- Met secretly with small group of Yam merchants.
- Pro Lester Union was formed by this small group of warriors and small group of weak, fat Yam merchants whose purpose was to train to defend Yam.

Koko prepared Mambo army for war by:

- First, worship of Solmambo, their sun-god.
  - Witch doctor and warriors looked directly into sun at high noon and chanted; witch doctor executed fifty warriors who couldn't do this.
- Next, painting warriors' faces with goat's blood for courage.

Mambo warriors, ready to fight, paddled canoes to Yam.

- Paddles could be used in many ways: spear, club, sword or double-edged axe because of sharp edges.

Lester's lookouts shouted alarm as canoes approached.

Yam musicians beat drums, blew ram horns, shook rattles, and did tribal dance to chase away evil spirits who might harm Lester during battle.

Lester Followers, made up of all Yam merchants and other Yam subjects and the Pro Lester Union, met the invaders.

Lester led his camel cavalry into battle, but fat merchants, outnumbered five to one, were no match for expert warriors.

Heavy iron sword of Lester's people difficult to use so Lester decided to win by killing Koko.

When Lester charged Koko, Koko sent his spear through Lester's chest, killing him and winning the battle.

Koko, proud of victory, now owned seven thousand slaves, two hundred thousand cattle and sheep, and business wealth of Yam.

After battle, Mambo becomes rich but social structure remains same with most people being expert warriors.

Yam changes; all Yam people and traitor Mambo warriors become slaves of Koko.

But there's legend that friendly spirits have taken seriously wounded Lester away to recover and he will come back to free his people.

This Lester Legend is told by his faithful subjects who secretly buried his dead body.

Many Yam slaves believe this legend.

Some of these legend believers and the traitor Mambo warriors, who don't believe the legend, form the Freedom Group to overthrow Koko.

Sometimes, Koko finds a skull in front of his hut or poison in his food.

He is grouchy and suspicious.

His relation with his troops is becoming unfriendly.

Victory may not be so sweet after all.

* * * *

Now that you have finished reading the story, raise your hand.

Appendix D Set Relations Test Items (S-R-1)

Read each set of two sentences and then choose the one that is true and mark your answer sheet accordingly. Remember, only one of the two sentences is correct. Begin immediately.

I. The following sentences describe life in Mambo and Yam before the battle.

1. A. All of the expert warriors belonged to the Pro Lester Union.

   B. Only some of the expert warriors belonged to the Pro Lester Union.

2. A. All of the merchants were Lester Followers.

   B. Only some of the merchants were Lester Followers.

3. A. Only some of the expert warriors were Mambo Citizens.

   B. All of the expert warriors were Mambo Citizens.

4. A. Only some of the Lester Followers were Mambo Citizens.

   B. All of the Lester Followers were Mambo Citizens.

5. A. No expert warriors were merchants.

   B. Only some of the expert warriors were merchants.

6. A. All of the Mambo Citizens belonged to the Pro Lester Union.

   B. Only some of the Mambo Citizens belonged to the Pro Lester Union.

7. A. Only some of the Lester Followers were expert warriors.

   B. All of the Lester Followers were expert warriors.

8. A. Only some of the Mambo Citizens were merchants.

   B. No Mambo Citizens were merchants.

9. A. Only some members of the Pro Lester Union were Lester Followers.

B. All members of the Pro Lester Union were Lester Followers.

10. A. All merchants were members of the Pro Lester Union.

B. Only some of the merchants were members of the Pro Lester Union.

II. The following sentences describe life in Mambo and Yam after the battle.

11. A. Only some of the Mambo Citizens belong to the Freedom Group.

B. All of the Mambo Citizens belong to the Freedom Group.

12. A. All of the legend believers are slaves.

B. Only some of the legend believers are slaves.

13. A. Only some of the expert warriors are legend believers.

B. No expert warriors are legend believers.

14. A. Only some members of the Freedom Group are slaves.

B. All members of the Freedom Group are slaves.

15. A. All of the Legend Believers belong to the Freedom Group.

B. Only some of the Legend Believers belong to the Freedom Group.

16. A. All of the expert warriors are Mambo Citizens.

B. Only some of the expert warriors are Mambo Citizens.

17. A. Only some of the slaves are expert warriors.

B. All of the slaves are expert warriors.

18. A. All of the expert warriors belong to the Freedom Group.

B. Only some of the expert warriors belong to the Freedom Group.

19. A. Only some of the Mambo Citizens are legend believers.

B. No Mambo Citizens are legend believers.

20. A. Only some of the slaves are Mambo Citizens.

B. All of the slaves are Mambo Citizens.

Appendix E
Multiple Choice Test Items (M-C-2)

With your pencil, draw a line through or circle on the answer sheet the phrase which best completes the sentence, either A, B, C, or D. Do not look back at the story, Now begin.

1. In 1800 two unfriendly nations existed in:
    - a) South America
    - b) Africa
    - c) Europe
    - d) North America

2. These two nations often fought wars over:
    - a) a border dispute
    - b) political viewpoints
    - c) business
    - d) religion

3. King Koko of Mambo was a:
    - a) military minded man
    - b) peace loving man
    - c) a generous man
    - d) a satisfied man

4. Among Mambo's subjects, there were very many:
    - a) priests
    - b) merchants
    - c) warriors
    - d) sailors

5. Koko and his followers earned money from other tribes by:

    a) trading with them

    b) fighting their battles

    c) selling them slaves

    d) protecting their camel caravans

6. Koko was getting old and tired so he planned:

    a) to take a vacation

    b) to defeat Yam

    c) to retire as ruler of Mambo

    d) to sign a treaty with Yam

7. Koko would become very rich if he:

    a) signed a treaty with Yam

    b) defeated Yam

    c) sold slaves to Yam

    d) fought a war for Yam

8. The Mambo warriors did not like King Lester of Yam because:

    a) Lester's subjects loved him

    b) Lester was an excellent hunter

    c) Lester was rich

    d) All of the above

9. The Mambo warriors were willing to fight Yam because:

    a) They wanted the wealth of Yam

    b) They did not like any Yam citizens

    c) They wanted to live in Yam

    d) None of the above

10. A small band of Mambo warriors decided:

    a) to help Lester in case of war
    b) to reveal Koko's plans to Lester
    c) to trade with some Yam merchants
    d) to work for peace

11. The Pro Lester Union consisted of a small group of Yam merchants and:

    a) Lester's warriors
    b) Some traitor Mambo warriors
    c) Some Mambo merchants
    d) All of the above

12. The Yam merchants of the Pro Lester Union were learning:

    a) how to become warriors
    b) how to become spies
    c) how to make weapons
    d) All of the above

13. Most of Lester's followers were:

    a) merchants
    b) warriors
    c) union members
    d) musicians

14. The Mambo army prepared for war by:

    a) dancing and shaking rattles
    b) painting their faces with goat's blood for courage
    c) beating drums and singing
    d) none of the above

15. Some historians believe that the Mambo warriors frightened their enemies because of:

    a) their goat-blood painted faces

    b) their terrible war cries

    c) their muscular bodies

    d) their war knowledge

16. The Mambo witch doctor killed fifty Mambo warriors because:

    a) they were religiously unworthy

    b) they were weak

    c) they were old

    d) they were traitors

17. The Mambo warriors had spears that were also:

    a) canoe paddles

    b) clubs

    c) swords

    d) all of the above

18. The Mambo warriors had an advantage in the war because:

    a) they had a versatile weapon

    b) the Yam Citizens were cowards

    c) Lester was not a good warrior

    d) all of the above

19. King Lester's lookouts announced the beginning of the war by:

    a) sending mirror signals

    b) shouting loudly

    c) setting a fire

    d) waving red flags

20. The Yam musicians danced and played music on seeing war canoes:

a) To encourage King Lester's warriors for fighting

b) To welcome the coming of the brave warriors

c) To chase away any evil spirits that might harm Lester during the battle

d) To show power and to frighten the enemy

21. The unusual sounds of the Yam musicians as the canoes approached were:

a) Ram horns blowing, drums beating, and rattles shaking

b) Whistles blowing and drums beating

c) Copper horns, drums beating

d) Drum beats and bell ringing

22. Lester's cavalry was:

a) horses

b) camels

c) elephants

d) donkeys

23. King Lester's weapons were:

a) sharp-pointed heavy daggers

b) sharp-edged light knives

c) sharp-pointed light arrows

d) sharp-edged heavy pieces of iron

24. The proportion of King Lester's warriors to King Koko's warriors was:

a) one to two

b) five to one

c) one to one

d) one to five

25. Who was losing the battle?

- a) King Lester and his followers
- b) Lester's lookouts who used the spears
- c) King Koko and his followers
- d) Koko's warriors who used the swords

26. King Lester's warriors were different from King Koko's warriors because most were:

- a) expert warriors
- b) non-expert warriors
- c) disloyal warriors
- d) all of the above

27. King Koko's weapons were:

- a) simple and effective
- b) heavy and complicated
- c) effective but not simple
- d) none of the above

28. Lester's plan to get rid of Koko was to:

- a) Bribe one of Koko's warriors to kill him
- b) Ask one of Koko's servants to poison his food
- c) Fight Koko in personal combat and kill him
- d) Say religious prayers for spirits to hinder and harm Koko

29. Lester was killed:

- a) by Koko's warriors
- b) by Koko's spear
- c) by Lester's warriors
- d) by committing suicide

30. Lester's followers after his death:

a) Became more fierce

b) Became more courageous

c) Became hopeless cowards

d) None of the above

31. At the end of the battle Koko was:

a) Unsatisfied with his victory and his new wealth

b) Unsatisfied with his new found wealth

c) Unsatisfied with his victory, but proud of his new found wealth

d) Proud of his victory and his new found wealth

32. The new found wealth of King Koko after the battle was:

a) Seven hundred slaves and two hundred cattle and sheep

b) Seven hundred thousand slaves and two hundred cattle and sheep

c) Seventy slaves and two hundred thousand cattle and sheep

d) Seven thousand slaves and two hundred thousand cattle and sheep

33. After the battle the people of Yam were:

a) Slaves for their new ruler

b) More prosperous than ever

c) Merchant warriors

d) Unhappy but proud of their occupations

34. Lester's dead body was buried by:

a) Koko's warriors

b) Lester's subjects

c) Lester's merchants

d) Koko's merchants

35. The rumor about Lester after his death was that:

a) The doctor of King Koko was treating him of his wounds

b) He was treated by some friendly spirits of his serious wounds

c) He was a guest at one of the neighboring tribes

d) He was burned up by King Koko's warriors

36. The rumor of Lester's return was told by:

a) Lester Legend Believers

b) Koko's doctor

c) Neighboring tribes

d) Koko's food tasters

37. The attitude of King Koko about the rumor of Lester's return was that he:

a) Felt indifferent since there was not too much harm in it

b) Discouraged the rumor to avoid the annoyment of his slaves

c) Felt uneasy about the increasing number of believers of this rumor

d) None of the above

38. The behavior of the Freedom Group was characterized by:

a) Negotiating with other tribes to invade Koko

b) Telling lies about Koko

c) Planning the overthrow of Koko

d) Helping slaves escape to other countries

39. The relationship between Koko and his troops was:

a) respect and loyalty

b) friendly

c) unfriendly

d) none of the above

Appendix F

Instruction for Reconstruction

Write all that you can remember about the story of Mambo and Yam.

Appendix G

Data Key for Set Relations Test

1. Subject number
2. Sex
3. Grade (6 thru 9)
4. Age (Expressed in decimals)
5. I.Q.
6. Reading Achievement (Expressed in decimals)
7. Time (Expressed in decimals)

Immediate Recall

8. Total number of correct nested items
9. Total number of correct disjunctive items
10. Grand total correct on all set relation items
11. Total S score (Number correct on nested items plus twenty, minus number correct on disjunctive items))

Delayed Recall

12. Total number of correct nested items
13. Total number of correct disjunctive items
14. Grand total number correct on all set relation items
15. Total S score (Number correct on nested items plus twenty, minus number correct on disjunctive items).

Set Relations Test--Original Data

Traditional Version of the Story (A-1)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
101	F	8	13.92	123	9.6	19.33
102	M	6	12.75	97	5.2	11.42
103	F	7	12.83	99	7.0	19.00
104	M	6	11.83	89	7.4	19.58
105	F	9	15.75	104	7.7	15.33
106	M	9	13.50	126	11.9	11.75
107	M	7	14.00	105	7.0	17.17
108	F	8	13.17		8.5	15.25
109	F	6	10.83	119	6.0	20.58
110	M	7	14.00	104	8.2	19.41
111	F	7	14.67			20.58
112	F	9	15.58	111		18.08
113	F	9	16.25	96	7.1	22.92
114	F	8	13.75	110	7.3	21.00
115	M	7	15.67	71	6.0	20.42
116	M	6	12.17	98		19.75
117	M	7	14.50	109	7.9	46.50
118	M	9				18.00
119	M	8				18.83

N=19

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
101	7	8	15	19	8	5	13	23
102	7	7	14	19	4	5	9	20
103	4	7	11	17	6	9	15	17
104	5	8	13	17	2	9	11	13
105	8	5	13	17	6	4	10	22
106	5	10	15	15	4	8	12	16
107	2	8	10	14	0	10	10	10
108	7	0	7	27	5	3	8	24
109	4	9	13	15	5	7	12	18
110	6	6	12	20	7	8	14	20
111	8	7	15	21	4	7	11	17
112	9	8	17	21	4	9	13	15
113	6	3	9	23	7	3	10	24
114	8	9	17	19	8	9	17	19
115	5	6	11	19	7	8	15	19
116	7	8	15	19	5	7	12	15
117	6	6	12	20	5	5	10	20
118	5	7	12	20	6	5	11	21
119	7	8	15	18	5	7	12	18

N=19

Telegraphic Version of the Story (B-1)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
201	M	9	14.17	104	7.9	16.25
202	M	7	15.25	79	5.7	13.92
203	M	7	12.17	133	7.9	10.00
204	F	7	14.75	91	7.4	14.00
205	M	6	13.00	97	6.0	13.08
206	M	8	14.08	124	9.6	11.25
207	M	8	13.75	128	12.0	11.75
208	M	7	15.17	100	7.0	16.83
209	M	6	12.08	95		15.75
210	M	9	15.92	95	7.7	19.42
211	M	7	13.50	108	5.1	30.58
212	F	9	14.17	140	9.4	6.25
213	M	6	13.50	99		9.25
214		9	15.00	104		8.92
215	M	9	13.83	131	7.2	14.50
216	M	8	15.00	72		21.50
217	M	8	13.17	104	8.2	19.50
218	F	9	16.25	73	6.4	7.25
219	M	7	13.92	101	6.7	6.00
220	M	7	14.33	88	6.0	24.83
221	M	6	13.33	67		29.50
222	F	6	13.92	76	4.7	15.73

N=22

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
201	5	8	13	17	5	6	11	19
202	5	9	14	16	0	6	6	14
203	5	7	12	18	3	7	10	16
204	5	4	9	21	6	4	10	22
205	4	8	12	16	6	5	11	21
206	4	7	12	18	5	8	13	17
207	9	10	19	19	9	8	17	21
208	2	8	10	14	4	10	15	14
209	6	8	14	18	2	5	7	17
210	4	6	10	18	2	8	11	14
211	7	8	15	19	7	8	15	19
212	5	9	14	16	5	9	14	16
213	7	10	17	17	8	8	16	20
214	8	9	17	19	7	8	15	18
215	5	9	14	16	6	8	14	18
216	4	4	8	20	4	4	8	20
217	5	9	14	16	5	7	12	18
218	6	6	12	20	0	10	10	10
219	4	8	12	16	3	7	10	16
220	2	8	10	14	5	4	9	21
221	5	9	14	16	7	8	15	19
222	4	4	8	20	5	4	9	21

N=22

Short Telegraphic Version of the Story (C-1)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
301	F	7	13.25	106	6.9	12.92
302	M	7	13.42	111	7.4	8.25
303	M	6	14.08	75	4.4	23.17
304	M	6	11.17	102	5.6	4.75
305	M	6	11.17	129	8.2	12.58
306	F	8	13.75	109	9.3	7.92
307	M	8	13.42	110	8.1	13.25
308	M	9	10.92	86	7.5	9.75
309	F	9	13.42	115	11.2	6.50
310	M	7	14.67	121	9.7	13.92
311	M	9	15.17		5.9	14.58
312	F	8	17.33	84		16.33
313	F	8	15.92	110		8.08
314	F	6	14.17	82		13.17
315	M	6	13.50	106		11.75
316	F	9	15.67	104	7.5	6.83
317	M	9	16.58	91	7.1	10.58
318	F	8	16.25	84	6.2	5.00
319	M	8	13.83	132	8.7	5.33
320	M	7	14.08	97	6.1	15.75
321	F	6	14.25	86		28.67
322	F	6	13.75	86		21.50

N=22

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
301	7	9	16	18	4	9	13	15
302	7	8	15	19	7	9	16	18
303	5	9	14	16	5	8	13	17
304	7	7	14	20	8	9	17	19
305	6	7	13	19	4	9	13	15
306	2	9	11	13	4	6	10	18
307	9	9	18	20	5	9	14	16
308	2	8	10	14	4	6	10	18
309	6	9	15	17	7	7	14	20
310	7	6	13	21	4	4	8	20
311	9	5	14	24	6	3	9	23
312	2	8	10	14	2	8	10	14
313	7	8	15	19	8	4	12	24
314	7	8	15	19	1	9	10	12
315	3	7	10	16	5	4	9	21
316	7	7	14	19	5	8	13	17
317	10	8	18	22	8	5	13	23
318	3	2	5	21	2	3	5	19
319	5	7	12	18	4	8	12	16
320	5	8	13	17	6	9	15	17
321	6	7	13	19	1	9	10	12
322	6	3	9	23	7	7	14	20

N=22

Appendix H

Data Key for Multiple Choice Test

1. Subject number
2. Sex
3. Grade (6 thru 9)
4. Age (Expressed in decimals)
5. I.Q.
6. Reading Achievement (Expressed in decimals)
7. Time (Expressed in decimals)

Immediate Recall

8. Total number of correct responses
9. Total number of correct responses on those items which are not necessarily answerable from information provided in every version of the story.
10. Total number of correct responses on those items which are definitely answerable from information provided in every version of the story.

Delayed Recall

11. Total number of correct responses
12. Total number of correct responses on those items which are not necessarily answerable from information provided in every version of the story.
13. Total number of correct responses on those items which are definitely answerable from information provided in every version of the story.

Multiple Choice Test--Original Data

Traditional Version of the Story (A-2)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
401	M	6	14.92	66	3.8	18.50
402	M	8	15.83	115	6.4	20.92
403	M	8	13.75	124	10.6	15.00
404	F	6	10.08	128	7.5	13.25
405	F	7	12.33	83	5.6	20.00
406	F	7	12.83	97	9.0	24.00
407	M	9	16.08	100	8.2	32.00
408	M	9	14.17	115	10.4	21.50
409	M	7	13.83			15.67
410	F	6	15.75	80		16.25
411	M	7	13.17	119	6.1	29.17
412	F	8	14.17	86		10.75
413	F	8	13.58	122		14.50
414	M	9	14.75	109	8.7	28.00
415	F	8	13.75	146	7.9	19.17
416	M	8	14.00	106	7.2	15.50
417	M	8	14.67			19.50
418	M	8	14.67			22.75
419	M	8				9.00

N=19

(1)	(8)	(9)	(10)	(11)	(12)	(13)
401	13	6	7	5	2	3
402	20	7	13	29	9	20
403	34	11	23	33	11	22
404	27	9	18	29	10	19
405	35	11	24	33	11	22
406	30	12	18	33	13	20
407	27	9	18	22	9	13
408	31	13	18	32	13	19
409	37	15	22	35	13	22
410	23	7	16	23	10	13
411	33	12	21	31	10	21
412	26	9	17	15	5	10
413	35	12	23	34	9	25
414	29	10	19	30	8	22
415	32	14	18	34	13	21
416	29	11	18	25	7	18
417	29	10	19	28	8	20
418	21	8	13	19	7	12
419	33	10	23	29	8	21

N=19

Telegraphic Version of the Story (B-2)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
501	F	8	14.00	109	10.6	8.25
502	M	6	13.58	99	6.4	15.50
503	M	7	12.58	123	8.7	15.75
504	F	7	14.33	79	5.9	11.92
505	M	9	14.42	121	9.8	17.42
506	F	9	15.83	119		22.42
507	F	8	13.33	113		12.67
508	F	7	12.00	104	4.9	14.33
509	M	7	14.25	94	5.8	11.58
510	M	6	12.08	113		9.25
511	F	7	13.33	90	6.1	13.17
512	M	9	16.42	103	7.9	14.25
513	M	9	16.75	94	7.5	15.83
514	F	8	13.75	104		11.33
515	M	7	15.17	97	5.3	15.00
516	F	7	12.92	92	6.4	16.50
517	M	6	12.75	93	5.0	16.50

N=17

(1)	(8)	(9)	(10)	(11)	(12)	(13)
501	31	9	22	28	6	22
502	24	6	18	24	7	17
503	24	9	15	27	9	18
504	19	4	15	22	5	17
505	31	10	21	33	11	22
506	28	7	21	30	7	23
507	10	4	6	15	6	9
508	21	6	15	24	7	17
509	13	3	10	13	1	12
510	26	6	20	26	8	18
511	31	7	24	28	6	22
512	20	7	13	22	6	16
513	28	6	22	19	5	14
514	26	5	21	19	5	14
515	19	4	15	16	3	13
516	18	4	14	25	9	16
517	29	8	21	23	4	19

N=17

Short Telegraphic Version of the Story (C-2)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
601	F	7	12.75	103	6.0	18.33
602	M	7	12.75	113	8.2	6.92
603	M	8	15.25	91	6.4	6.75
604	M	6	11.83	111	6.6	7.58
605	F	8	14.58	103	10.1	7.00
606	F	9	16.33	86	8.3	11.99
607	M	9	14.42	100	8.3	7.50
608	M	7	14.83	92	5.5	7.58
609	F	6	12.00	123		10.25
610	M	6	14.67	80		9.25
611	M	7	13.33	101	5.1	7.00
612	F	9	14.58	104	9.1	9.58
613	F	8	14.83	91		9.67
614	F	9	14.42	130	9.9	8.25
615	M	9	14.58	150	8.2	6.42
616	M	8	15.17	86	6.7	5.75
617	M	8	13.25	106	6.8	6.42
618	M	7	12.08	105	6.2	10.67
619	F	6	13.92	112		17.50
620	M	6	12.83	117	7.3	9.25
621	F	7	12.58	97	5.9	6.67

N=21

(1)	(8)	(9)	(10)	(11)	(12)	(13)
601	12	2	10	11	3	8
602	24	7	17	31	9	22
603	22	8	14	22	5	17
604	30	7	23	23	6	17
605	29	7	22	23	4	19
606	17	6	11	13	3	10
607	27	10	17	27	8	19
608	14	3	11	12	3	9
609	13	4	9	11	4	7
610	22	6	16	21	7	14
611	27	10	17	23	4	19
612	24	7	17	24	9	15
613	17	6	11	10	3	7
614	30	9	21	28	9	19
615	33	10	23	30	10	20
616	13	6	7	9	5	4
617	32	8	24	29	8	21
618	19	6	13	19	4	15
619	20	5	15	18	3	15
620	15	3	12	0	0	0
621	12	3	9	0	0	0

N=21

Appendix I

Data Key for Reconstruction Test

1. Subject number.
2. Sex
3. Grade (6 thru 9)
4. Age (Expressed in decimals)
5. I.Q.
6. Reading Achievement (Expressed in decimals)
7. Time (Expressed in decimals)

Immediate Recall

8. Total number of sentences
9. Average number of words per sentence
10. Number of kernel elements as rewritten by the experimenter
11. Number of exact matches as rewritten by the experimenter and matched to one of the 331 kernels of the traditional version of the story.
12. Number of true inferences but not actually matched to a particular kernel. (TNM)
13. Total number of words
14. Nouns
15. Verbs
16. Adjectives
17. Adverbs
18. Pronouns
19. Prepositions
20. Conjuctions
21. Determiners

22. Noun Modifiers

23. Expletives

24. Possessive Pronouns

25. Possessive Nouns

26. Interjections

27. Negative Adverbs

28. Number of different key words found in the subjects as matched to a list of key words which were selected from the corresponding A, B, or C version of the original passages.

29. Total number of key words

Delayed Recall

30. Total number of sentences

31. Average number of words per sentence

32. Number of kernel elements as rewritten by the experimenter

33. Number of exact matches as rewritten by the experimenter and matched to one of the 331 kernels of the traditional version of the story.

34. Number of true inferences but not actually matched to a particular kernel (TNM).

35. Total number of words

36. Nouns

37. Verbs

38. Adjectives

39. Adverbs

40. Pronouns

41. Prepositions

42. Conjunctions

43. Determiners

44. Noun Modifiers

45. Expletives

46. Possessive Pronouns

47. Possessive Nouns

48. Interjections

49. Negative Adverbs

50. Number of different key words found in the subjects writing as matched to a list of key words which were selected from the corresponding A, B, or C versions of the original passages.

51. Total number of key words

Reconstruction Test--Original Data

Traditional Version of the Story (A-3)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
701	M	7	14.00			16.00
702	M	7	14.00	86	4.8	4.33
703	M	6	11.83	104	3.2	68.25
704	F	9	15.17	93	9.1	17.33
705	M	7	12.00	130	10.5	20.92
706	F	9	14.33	120	6.0	20.00
707	F	6	12.75	86	7.2	30.42
708	F	8	14.42		5.3	31.83
709	F	8	14.08	85	8.0	13.83
710	F	7	13.67	95	5.1	25.83
711	M	8	13.17	122	8.5	29.50
712	M	9	13.92	107	7.4	21.92
713	M	9	14.83	108		13.25
714	F	9	15.83	127	9.5	16.92
715	F	8	12.92	119	6.7	15.00
716	M	8	14.92	101	8.7	48.25
717	M	7	15.50	85	5.8	26.50
718	F	7	14.42	98	5.7	16.42
719	M	6	14.67	69		15.00
720	M	6	13.92	101		40.50

N=20

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
701	4	6.5	13	10	3	26	10
702	6	8.5	15	9	4	51	15
703	1	2.0	4	2	2	20	7
704	10	16.1	35	13	12	161	38
705	7	14.7	26	20	6	103	31
706	23	14.9	64	58	3	343	89
707	16	11.6	38	28	8	186	46
708	11	16.7	31	16	9	183	38
709	11	12.8	25	5	8	141	37
710	26	7.5	42	33	7	195	57
711	11	7.6	24	18	1	83	28
712	11	14.3	35	22	9	163	49
713	18	10.2	38	32	4	183	43
714	30	15.8	97	66	14	473	109
715	21	17.8	70	60	7	373	82
716	12	11.7	37	33	1	140	42
717	11	14.0	31	11	14	154	37
718	25	13.2	64	46	14	331	68
719	14	12.4	38	26	3	174	46
720	15	5.7	25	23	2	85	26

N=20

Traditional Version of the Story (A-3) cont.

(1)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
701	6	1	0	1	3	0	2
702	11	1	1	2	2	2	0
703	3	3	1	0	0	1	3
704	25	9	16	12	20	4	23
705	19	8	1	6	6	9	8
706	60	20	13	17	29	25	38
707	31	9	9	12	18	14	12
708	36	13	11	23	5	18	12
709	25	10	9	11	17	11	6
710	38	9	9	15	9	10	22
711	12	4	2	3	10	4	9
712	24	8	5	7	18	9	20
713	36	23	7	20	13	15	15
714	78	35	27	35	43	40	23
715	62	25	18	39	39	16	35
716	23	10	3	8	15	8	12
717	25	12	7	12	18	10	12
718	61	30	27	47	26	25	20
719	30	8	6	11	16	15	14
720	18	7	4	4	7	3	5

N=20

(1)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
701	4	0	0	0	0	0	10	18
702	6	2	1	0	0	0	16	26
703	0	1	0	0	0	0	4	5
704	4	0	1	0	0	1	32	44
705	6	0	3	0	0	2	25	44
706	12	3	4	4	0	4	62	111
707	17	0	7	2	0	0	43	84
708	4	2	4	0	0	0	34	48
709	1	0	4	1	0	0	16	33
710	8	2	0	1	0	1	37	72
711	5	1	1	3	0	0	16	41
712	5	0	5	0	0	0	32	58
713	0	0	0	0	0	2	36	64
714	18	4	11	2	0	7	67	134
715	15	2	4	3	0	4	56	121
716	6	1	0	1	0	2	28	52
717	9	1	1	1	0	1	24	49
718	2	0	0	2	0	0	59	101
719	14	1	0	1	0	0	34	71
720	7	1	0	0	0	2	19	38

N=20

Traditional Version of the Story (A-3) cont.

(1)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
701	8	5.6	18	10	7	45	17	7	3	0	4
702	2	12.0	6	4	1	24	7	4	2	0	1
703	8	7.0	13	5	1	56	13	10	12	3	2
704	9	13.0	23	10	10	117	32	17	8	4	11
705	6	9.3	14	9	2	56	11	13	2	1	2
706	12	14.1	39	33	4	169	50	30	10	4	7
707	23	11.6	48	34	9	266	64	48	12	20	21
708	10	17.3	29	12	5	173	38	34	9	8	14
709	10	16.9	21	2	2	169	35	26	13	13	11
710	20	10.4	38	23	3	207	47	30	19	8	10
711	6	6.2	10	8	1	37	11	6	3	2	3
712	15	16.9	48	37	7	253	66	42	8	11	18
713	16	14.3	40	25	1	227	57	35	23	7	16
714	29	12.5	70	44	22	361	87	61	39	23	19
715	20	19.3	59	35	18	386	77	69	17	26	35
716	36	11.0	84	70	6	395	117	82	40	22	24
717	11	15.5	33	21	6	170	44	27	18	6	8
718	31	12.5	59	44	2	386	81	64	28	29	35
719	9	14.2	21	10	4	128	38	18	11	4	3
720	13	7.1	28	23	4	92	25	19	4	2	7

N=20

(1)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)	(51)
701	1	3	4	5	0	1	0	0	1	12	24
702	1	2	4	1	0	1	0	0	0	4	7
703	3	2	5	0	1	0	0	0	0	13	19
704	15	7	12	2	0	3	0	0	0	23	38
705	1	2	2	7	0	1	3	0	1	15	27
706	16	10	17	7	2	4	2	0	1	35	65
707	19	18	19	18	1	6	1	0	0	40	102
708	10	18	16	3	3	1	0	3	0	18	38
709	18	1	12	1	3	4	2	0	1	15	33
710	10	17	10	18	1	2	5	0	1	27	79
711	4	2	4	0	1	0	0	0	1	8	12
712	25	19	20	16	2	4	4	0	1	35	87
713	25	17	21	0	0	5	0	0	3	29	60
714	34	15	22	7	2	7	0	0	3	57	101
715	28	32	20	27	1	8	6	0	5	44	128
716	29	32	45	17	1	10	4	0	3	63	138
717	12	15	15	9	1	2	2	0	2	21	56
718	36	22	45	8	1	13	1	0	3	49	94
719	7	13	13	13	1	3	0	0	0	19	52
720	11	3	7	6	1	0	0	0	2	20	38

N=20

Telegraphic Version of the Story (B-3)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
801	F	7	12.83	111	10.0	13.58
802	M	6	11.75	118	7.2	13.67
803	M	7	14.00	94	6.4	10.92
804	F	6	11.58	93	5.2	41.67
805	M	8	17.08	91	5.3	23.33
806	F	8	13.33	108	7.3	9.17
807	M	7	13.58	129	10.1	12.00
808	M	7	14.50	90	5.0	14.75
809	F	6	12.50	85	4.8	16.58
810	M	7	14.75	82	5.6	11.08
811	M	7	14.75	97	5.6	8.08
812	F	8	14.25	91		16.83
813	F	7	13.92	113	5.8	13.33
814	M	9	15.67	112	8.3	10.00
815	F	9	15.67	106	7.5	13.25
816	F	9	14.75	126	9.1	8.92
817	F	8	16.17	64		13.00
818	F	8	13.33	116	7.1	14.75
819	M	7	13.92	118	7.2	18.75
820	M	6	13.75	81	6.2	21.83

N=20

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
801	12	8.1	28	26	2	97	34
802	2	8.0	9	9	0	16	5
803	9	10.4	21	16	3	94	20
804	5	14.8	17	6	5	74	19
805	12	14.3	40	27	9	172	41
806	9	14.7	19	12	4	133	30
807	19	14.2	62	41	6	270	73
808	19	8.3	28	21	5	157	35
809	3	10.0	13	7	1	30	7
810	6	12.3	20	14	4	74	21
811	7	9.3	22	17	4	65	20
812	18	14.7	62	52	2	265	62
813	9	15.6	29	20	6	140	35
814	11	13.8	31	24	2	152	42
815	24	19.1	83	62	15	458	113
816	12	11.9	31	25	3	143	39
817	6	10.5	11	7	1	63	15
818	35	12.2	86	71	11	426	101
819	17	15.4	48	39	2	261	56
820	10	6.6	23	15	4	66	17

N=20

Telegraphic Version of the Story (B-3) cont.

(1)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
801	15	1	3	4	9	2	8
802	3	0	0	0	2	0	1
803	17	3	10	10	8	3	9
804	11	3	3	5	8	6	7
805	30	14	4	8	13	11	24
806	26	13	8	13	10	10	6
807	46	21	10	17	23	19	16
808	31	18	8	12	10	3	17
809	7	2	1	2	2	2	3
810	15	2	1	3	7	6	6
811	10	8	2	2	6	4	7
812	47	12	8	22	26	18	17
813	31	6	3	15	9	12	14
814	26	9	4	10	17	12	7
815	73	28	19	31	38	44	45
816	23	8	10	9	12	10	12
817	12	6	3	3	6	3	3
818	62	27	23	26	43	36	36
819	50	17	18	24	17	22	18
820	12	3	3	8	5	3	6

N=20

(1)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
801	6	0	4	1	0	1	27	50
802	4	0	1	0	0	0	8	9
803	7	0	1	1	0	0	20	32
804	2	0	2	3	0	0	23	32
805	7	0	5	0	0	1	36	62
806	1	1	2	3	0	1	25	36
807	5	0	3	10	0	1	60	104
808	0	0	2	0	0	0	29	50
809	2	0	0	0	0	0	11	13
810	1	1	3	1	0	0	18	28
811	0	1	1	0	0	0	15	24
812	20	3	4	0	0	1	58	105
813	0	1	1	0	0	1	22	37
814	13	3	2	1	0	2	25	52
815	16	3	14	3	0	4	66	146
816	0	1	4	2	0	3	25	38
817	0	2	1	1	0	3	12	18
818	10	2	9	6	0	4	63	143
819	10	2	8	2	0	2	51	86
820	4	1	1	1	0	0	15	25

N=20

Telegraphic Version of the Story (B-3) cont.

(1)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
801	9	9.0	22	20	1	81	21	14	1	2	10
802	7	7.6	14	8	2	53	15	11	4	3	4
803	7	10.1	17	13	0	71	14	12	2	2	7
804	5	20.4	11	7	4	102	21	16	2	3	7
805	12	18.8	46	36	6	225	54	38	14	10	12
806	8	12.9	16	8	6	103	23	15	12	5	10
807	22	9.7	52	35	2	213	79	48	24	13	25
808	11	9.4	15	1	5	103	27	18	11	9	7
809	4	6.0	9	8	0	24	7	4	0	0	0
810	8	7.9	17	11	4	63	16	11	8	3	5
811	6	9.8	18	14	1	59	13	12	3	1	4
812	8	18.8	31	30	1	150	36	27	10	4	11
813	8	11.0	16	7	7	88	20	14	7	3	6
814	14	18.4	50	24	11	261	60	42	18	8	21
815	20	15.9	53	49	1	318	69	44	15	9	21
816	17	12.9	48	35	9	220	51	37	21	18	13
817	11	11.9	17	4	2	131	25	30	14	5	16
818	41	10.0	82	50	23	410	90	83	27	32	48
819	26	17.3	72	40	25	449	96	74	37	21	33
820	11	9.0	20	13	5	99	25	14	7	3	9

N=20

(1)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)	(51)
801	9	4	2	6	0	6	0	0	0	22	38
802	4	2	3	3	0	2	0	1	0	11	17
803	4	4	6	6	0	2	1	0	0	14	26
804	6	13	10	3	0	1	4	0	0	15	26
805	16	19	25	6	2	7	0	0	4	34	62
806	8	4	9	3	1	3	5	0	1	15	31
807	33	14	28	4	1	2	11	0	5	43	88
808	6	6	14	0	0	2	2	0	1	14	29
809	1	3	2	3	0	0	0	0	1	7	11
810	3	3	5	0	1	3	2	0	0	13	21
811	6	5	1	5	1	2	0	0	0	14	25
812	13	13	6	9	1	6	3	0	1	40	62
813	8	5	8	3	1	2	0	0	1	11	19
814	23	25	19	16	1	4	1	0	4	27	73
815	29	25	26	4	1	3	2	0	1	39	89
816	14	20	11	3	1	6	5	0	2	26	53
817	9	7	9	0	1	0	0	0	4	8	20
818	36	34	35	20	1	8	4	0	8	60	132
819	35	37	43	19	4	10	1	0	3	55	123
820	9	7	6	8	0	5	2	0	0	15	28

N=20

Short Telegraphic Version of the Story (C-3)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
901	M	7	13.00	110	5.4	13.75
902	F	8	14.25	91	7.0	7.75
903	F	9	13.75	111	8.5	8.50
904	M	9	14.58	91	8.8	10.00
905	M	8	14.00	113	4.9	16.25
906	M	6	12.25	93	6.8	7.58
907	F	7	13.17	128	10.7	7.17
908	F	7	13.75	81	6.2	6.08
909	F	9	17.25		8.6	14.58
910	F	9	15.50	128	11.3	6.58
911	M	7	13.17	115	6.3	5.17
912	M	9	14.25	109	7.1	8.25
913	F	8	12.92	110	6.9	6.00
914	M	6	12.92	93	5.6	11.00
915	M	8	15.17	77	6.7	3.17
916	M	6				9.00
917	M	7				9.00
918	M	7				10.00
919	F	9	14.00			6.67
920	F	8	14.67			9.00

N=20

(1)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
901	7	6.7	16	15	1	47	16
902	9	9.7	23	11	3	87	31
903	6	13.8	21	12	3	83	26
904	7	9.3	13	7	3	65	17
905	14	13.6	39	34	2	191	52
906	11	11.6	33	30	1	128	34
907	12	13.3	44	30	12	160	38
908	11	14.0	32	14	3	150	37
909	7	14.0	23	21	1	98	34
910	17	14.1	61	46	11	239	65
911	5	18.4	26	22	0	92	22
912	10	12.9	36	28	8	129	38
913	9	13.6	28	16	3	122	35
914	4	19.5	19	10	1	78	21
915	4	9.5	11	7	1	38	10
916	14	13.0	39	34	2	182	49
917	1	17.0	5	0	0	17	6
918	20	11.1	37	22	10	222	65
919	39	8.8	63	57	2	345	85
920	7	7.6	14	12	0	53	19

N=20

Short Telegraphic Version of the Story (C-3) cont.

(1)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
901	10	6	1	0	3	2	5
902	14	7	4	2	4	12	3
903	13	9	3	6	9	6	6
904	15	4	2	3	5	3	6
905	37	15	5	9	15	19	11
906	26	6	6	9	8	8	10
907	29	9	2	12	18	7	16
908	33	12	11	8	9	15	11
909	16	5	2	3	14	7	7
910	44	17	8	20	23	14	15
911	18	7	5	7	5	6	11
912	21	7	3	8	14	5	11
913	19	8	4	4	12	10	13
914	15	5	1	6	4	7	3
915	7	3	5	2	2	1	4
916	36	4	3	13	9	12	14
917	1	1	0	0	4	1	3
918	38	16	5	12	24	13	19
919	69	17	11	33	26	24	29
920	8	3	0	4	7	3	5

N=20

(1)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
901	0	0	0	1	0	0	12	15
902	1	0	0	4	0	0	19	44
903	2	0	0	0	0	1	21	29
904	0	0	0	2	0	0	11	17
905	1	0	11	4	0	2	36	61
906	4	0	2	2	0	2	35	48
907	6	0	3	3	0	5	33	52
908	5	1	0	0	0	3	25	50
909	0	0	3	2	0	1	19	38
910	1	0	11	3	0	4	45	77
911	2	0	1	2	0	2	26	34
912	5	0	3	0	0	4	34	57
913	3	1	3	1	0	1	19	42
914	0	0	5	2	0	2	15	24
915	2	0	0	0	0	0	10	11
916	13	0	2	4	0	3	30	64
917	0	0	0	0	0	0	6	6
918	11	2	1	1	0	2	75	79
919	11	2	10	1	0	5	53	106
920	2	0	0	0	0	1	13	22

N=20

Telegraphic Version of the Story (C-3) cont.

(1)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
901	4	13.0	12	8	4	52	13	12	5	0	1
902	11	11.7	24	17	6	129	40	22	13	2	6
903	9	8.1	12	1	8	73	15	13	8	3	9
904	5	7.2	10	4	3	36	9	9	5	0	2
905	12	16.4	42	35	2	192	46	28	14	9	9
906	17	9.1	41	38	2	154	44	31	8	5	9
907	14	12.1	30	0	0	170	42	28	13	5	10
908	10	16.6	27	10	3	166	35	33	11	5	10
909	6	14.2	20	15	4	85	30	13	6	2	3
910	16	14.3	46	37	5	228	52	39	15	7	25
911	2	18.5	9	9	0	37	11	5	3	2	4
912	12	12.6	35	29	3	151	45	30	6	5	9
913	8	5.3	22	14	3	42	24	15	2	11	5
914	10	19.1	9	8	0	191	34	28	35	4	18
915	5	8.4	9	5	1	42	13	7	4	3	1
916	10	12.7	27	18	8	127	28	26	8	5	11
917	1	14.0	5	4	1	14	4	1	0	0	0
918	16	10.3	34	20	12	165	46	32	12	2	10
919	16	9.3	36	24	10	148	41	28	10	7	12
920	6	5.7	12	8	2	34	12	7	4	0	0

N=20

(1)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)	(51)
901	0	5	3	0	1	1	1	0	1	12	19
902	0	6	7	9	0	3	0	0	0	21	62
903	6	3	12	0	0	0	0	0	1	10	15
904	2	2	1	0	0	1	2	0	0	7	9
905	20	17	17	2	1	4	4	0	3	32	54
906	12	9	13	5	1	3	0	0	1	38	64
907	13	14	14	12	0	6	4	0	3	34	63
908	11	23	16	6	1	1	0	0	0	23	48
909	10	6	10	0	0	0	1	0	0	16	38
910	24	14	18	3	0	8	0	0	3	31	51
911	3	1	2	2	0	1	0	0	0	5	7
912	16	8	13	7	1	0	0	0	1	28	61
913	8	5	7	4	1	5	1	0	2	15	30
914	16	12	23	0	0	1	4	0	1	19	53
915	4	1	4	1	1	0	0	0	0	8	9
916	4	7	10	9	0	1	0	0	3	16	44
917	3	0	3	2	0	0	0	0	0	4	4
918	19	8	10	9	1	0	0	0	0	21	60
919	16	11	7	0	1	3	3	0	0	26	48
920	5	1	2	0	0	0	0	0	0	11	13

N=20

Appendix J

Rewrite Procedure

The rewrite procedure consisted of rewriting the subjects' reconstructions into kernel sentences and then matching the kernels with the master kernel list derived from version A.

The first task in rewriting a subject's reconstruction was the identification of the noun and verb phrases. Since a kernel sentence consists of a noun and verb phrase, identification of such phrases permitted further identification of the subordinated or coordinated kernels. In addition, all words and word clusters were categorized into noun, verb, adjectival or adverbial form classes. This facilitated the identification of noun and verb phrases which could be rewritten into kernel elements. Table J.1 presents the kernel sentence analysis of a reconstruction written by S 187. Form class words and word clusters are labeled and the verb phrase of each kernel underlined.

Table J.2 presents the kernel sentences which were derived from the material presented in Table J.1. Each kernel sentence which could be matched to a kernel sentence on the master list is preceded by the number of the master list kernel.

Kernels which could not be matched to any on the master list were labeled according to one of the five categories defined in the Methods Chapter. Subject 187's reconstruction contained two such kernels.

Table J.1. Grammatical analysis of a subject's reconstruction.

```
                N        V           ADV
     When the battle had gone on for a while King Lester saw that they were los-

                 N1   V                N2                  V                ADJ
ing even though they had sharp-edged pieces of iron that could cut off the enemy's

 N2       ADV                N1          V               N2           ADJ
head with one stroke.  The men of Mambo outnumbered the Yam men five to one.

        N1          V                          N2
     King Lester decided that (if he was to win the war) he would have to do

                                      N1     V         N2    ADJ    N2    V
personal battle with Koko.  Just as Lester threw his weapon Koko's spear went

      ADJ     N2          N1     V               N2        V               N2
into Lesters chest.  The spear went through his chest and came out of his back

     N1    V        N2
and Mambo won the battle.
```

Table J.2. Rewritten kernels from subject's original reconstruction and master list kernel numbers.

12 Lester saw that they were losing.
23 The battle had gone on for a while.
6 They had pieces of iron.
7 Pieces were sharp-edged.
9 Pieces could cut off head.
10 Head was enemy's.
11 Pieces could cut off head with one stroke.
16 Men of Mambo outnumbered men of Yam.
17 Men of Mambo outnumbered men of Yam five to one.
30 King Lester decided (if he was to win war) he would have to do personal combat with Koko.
FS Lester threw his weapon.
38 Spear went into chest.
39 Chest was Lester's.
36 Spear was Koko's.
TNM Spear went through his chest.
41 Spear came out of his back.
48 Mambo won the battle.

The following material is an excerpt from version A upon which a portion of the reconstruction was based.

> Nevertheless the battle continued with the battlefield being a mass of men, spears, camels, swords, screams, and blood. Lester decided that the only way he could win would be to fight Koko in personal combat and kill him. Lester saw Koko and charged at him with his sword so he could cut his head off. But before he could strike, Koko sent his spear into Lester's chest. Koko threw the spear so hard that it came out through Lester's back. After this the Yam warriors fled in terror; they became helpless cowards without their leader. Mambo had won the battle.

The following kernels were selected from the master list of kernels and represent the corresponding matches indicated in Table J.2.

1. Traitor Mambo warriors came running.
2. Some warriors came panting.
3. Warriors came to meet the invaders.
4. Lester entered battle.
5. Lester entered with camel cavalry.
6. Warriors wielded pieces of iron.
7. Pieces were sharp edged.
8. Pieces were heavy.
9. Pieces could cut off head.
10. Head was enemy's.
11. Pieces could cut off with single stroke.
12. Lester was losing battle.
13. (Lester's) forces were losing battle.
14. Reason was fact that Yam warriors were no match for Mambo's.
15. Lester's army was small.
16. Lester's army was outnumbered.
17. Army was outnumbered five to one.
18. Lester's swords were difficult to use.
19. Koko's spears could be used with ease.
20. Koko's spears could be used in many ways.
21. Koko's weapon was simple.
22. Koko's weapon was effective.
23. Battle continued.
24. Battlefield was mass of men.
25. Battlefield was mass of spears.
26. Battlefield was mass of camels.
27. Battlefield was mass of swords.
28. Battlefield was mass of screams.
29. Battlefield was mass of blood.
30. Lester decided that way to win would be to fight Koko in personal combat.
31. Lester decided that way to win would be to kill Koko.
32. Lester saw Koko.

33. Lester charged at him.
34. Lester charged with his sword.
35. Lester charged so he could cut his head off.
36. Koko sent his spear.
37. Koko sent his spear before Lester could strike.
38. Koko sent his spear into chest.
39. Chest was Lester's.
40. Koko threw his spear so hard.
41. Spear came out through back.
42. Back was Lester's.
43. Yam warriors fled after this.
44. Yam warriors fled in terror.
45. Yam warriors became cowards.
46. Cowards were helpless.
47. Yam warriors became cowards without their leader.
48. Mambo had won the battle.

In spite of the relative complexity of this scoring procedure, it did yield rather high inter-judge reliability estimates. The reconstructions of 15 randomly chosen subjects were each rewritten into kernel form by three independent judges. The subjects were then ranked on the basis of the total number of kernel sentences. Hoyt's (1941) analysis of variance indicated that the reliability of this ranking was .99. The same three judges repeated this procedure on a second sample of 20 different subjects and obtained a reliability coefficient of .97.

A further analysis was performed in order to determine whether the judges agreed on the total number of assigned matches. Again, 20 randomly selected subjects were chosen and the three judges matched their kernels to the master list of kernels. The subjects were then ranked on the basis of the number of matches assigned by each judge. The reliability was determined by the Kendall coefficient of concordance which yielded a $\underline{W}$ value of .91.

These results indicated that this scoring procedure resulted in a fairly high degree of agreement among judges on total number of kernel elements and total number of matches.